Arctic whaling

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HISTORICAL SURVEY OF THE EUROPEAN WHALING INDUSTRY

by

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Defining the Arctic is not just a question of latitude. Southampton Island in the north of Hudson Bay, surrounded by ice in winter and the centre of a historic Arctic whale fishery, is in the same latitude, namely just south of the Arctic Circle, as Iceland. Yet the offshore whale-fishery of Iceland is rightly held to be North Atlantic in character rather than Arctic. The same applies to the hunting of the pilot whale *Globicephala melaena* in the Faroes (not to mention Newfoundland and Cape Cod) and even to the destruction of the blue whale *Balaena musculus* in the Varanger Fjord in 1867-1900 (Risting 1922: 110-163; Johnsen 1959) at 70° North, the same latitude as Disko. These are not Arctic animals, nor are these fisheries Arctic. In what follows discussion will be limited geographically to that half of the Arctic between 90° West and 90° East longitude, namely approximately between Hudson Bay and the Taymyr Peninsula.

It makes sense to consider the history of Arctic whaling in the first place in terms of the whale. Of the seventy-six species of cetaceans in the world we are concerned with three only, the most important of which is the Greenland right or bowhead whale *Balaena mysticetus.* This is the only large species limited to strictly Arctic waters which was numerous, slow-moving and accessible enough to be effectivily hunted there by man.

Apart from the bowhead, two smaller truly Arctic cetaceans have been hunted and ought to be mentioned here. They are the two members of the Monodontidae family, the narwhal *Monodon monoceros* and the white whale or beluga *Delphinapterus leucas.* The narwhal was already being hunted by European settlers in Greenland in the eleventh century and its ivory exported (Vaughan 1981:17). Crowds of these animals coming up to breathe at a single weak place or hole in the ice occasionally allow the Greenlanders to kill large numbers at once. One of the most spectacular of these hunts, called *savssat,* occured in Disko Bugt in the winter of 1914-1915, when some 2.000 were killed. Nowadays the Greenlanders' total annual catch is around 500 animals, and the Canadian (not exclusively Inuit) catch, which at one time approached 3.000 in a single year, is now limited by quota to 335 animals (Muus and others 1982: 439-440).

The annual Greenlandic kill of white whales has been stable at between 500 and 1.000 per annum for more than a hundred years (Rink 1877: 122-130 and

Muus and others 1982:437). In the USSR, this species has been netted or harpooned by the Samoyeds and other native peoples and attempts to develop this fishery in the Ob-Yenisei area were made by the Taymyr and Northern Urals Trusts in the 1930s (Taracouzio 1938: 220-222). In 1878 Nordenskiöld was told at Khabarovo on the south shore of the Proliv Yugorskiy Shar that the local whaling company *(artel),* the thirty shares of which were held by nine Russians and St. Nicholas (two shares), was producing 1.500-2.000 poods of train oil annually from white whales. At that time they were being hunted successfully by Norwegians using nets both off Spitsbergen and Novaya Zemlya (Nordenskiöld 1881a: 75-90 and 180-200). Tromsø vessels took 2.167 white whales in 1871 alone.

In the case of the bowhead whale, the native contribution to the annual catch has been small when compared to that of the European whalers. Indeed, in the area under consideration, native whalehunting took place only in Hudson Strait, along the western coast of Baffin Island, off the west Greenland coast, and at Angmagssalik. In west Greenland Hans Egede described and illustrated Inuit whaling with umiaks in his account of Greenland published in 1741, but it was already in decline by that time. The annual catch was probably under ten. Besides the bowhead, the humpback whale *Megaptera novaeangliae* has been hunted by Inuit from Frederikshåb and Godthåb (now Nuuk); the annual catch was put at 2-3 in the nineteenth century (Rink 1877:127-128 and Vanhöffen 1897:36-37).

In west Greenland a curious mixed native-European bowhead fishery was developed by the Danes between about 1776 and the late nineteenth century. This was based on shore stations between Sukkertoppen in the south and Upernavik in the north; the most important ones being Holsteinsborg and Godhavn. These processing stations and their look-out posts were manned through the winter, for the whales were only present close inshore between November and February. The Greenlanders caught them themselves, using European whale-boats and tackle. The catch was at first 20-30 per annum at the end of the eighteenth century, but it declined to half that amount in 1800-1850 and by 1870 only one animal a year was averaged from the only station still working - Holsteinsborg (Eschricht and Reinhardt 1866: 4-14, Rink 1877: 121-122, Vanhöffen 1897: 34-35 and Gad 1973: 387-391, 405-407).

Research in the annual reports of the different factories could certainly establish accurate production figures for this Danish-Greenlandic fishery. Similarly, only further research will make it possible to estimate the annual bowhead cull by European whalers in the seas on either side of Greenland within, say, a ten per cent margin of error. When figures are presented, their sources must be given in detail so that figures at variance with one another can be compared and verified. Take, for example, Ross's pioneering paper (1979)

on the annual catch of bowheads in waters north of Canada from 1719 to 1915. When discrepancies are found between Ross's (100) annual figures for Dutch whalers and whales caught, in Davis Strait in the first decades of the eighteenth century, and de Jong's (1979:162), or between Ross's German figures and those that can be found in Oesau (1937 and 1955) and Brinner (1913), Ross's documentation turns out to be insufficient for these discrepancies to be resolved. In fact, we are in no position to present definitive figures of the whale cull of any European fishery at this stage. According to Ross, the David Strait fishery yielded 28.394 whales in the years he covers, or an average of about 145 whales per annum. This figure includes an estimated 413 whales taken by American whalers and excludes an unknown number taken by French, Danish and other whalers and by British whalers before 1814. Ross himself admits its provisional character. We shall return later to the Davis Strait fishery.

Apart from the careful investigation and detailed documentation of production figures, attention needs to be given to the way these figures and therefore the history of European whaling as a whole, can best be presented. So far, nationalism in Europe has dictated a division of whaling history by nations or states, even though in fact whaling was for the most part not undertaken by states. Thus, we have the histories of the Danish-Norwegian whaling industry by Dalgård (1967), of the Dutch whaling industry by de Jong (1972-1979), of the German Arctic whaling industry by Brinner (1913), and *The British whaling trade* by Gordon Jackson (1978). Each national state must necessarily create an independent and exclusive past for itself; but what was the state of affairs in reality?

When the French and Spanish were doing their best to wage war on one another in the middle years of the sixteenth century, their Basque subjects, fishing off Terranova, now Newfoundland, made local non-aggression pacts between themselves so that they could continue their whaling operations in peace and quiet (Ciriquiain-Gaiztarro 1961:220—225). These whalers were Basques from a group of Biscay ports on either side of the Pyrenees, rather than French or Spanish. Similarly, one can appreciate the problems with which Dalgård found himself wrestling when he came to write the history of what he called the Danish-Norwegian whale fishery. After all, Johan Braem, for nearly thirty years in the first half of the seventeenth century the uncrowned king of Danish whaling, had only moved to Copenhagen from his probably native Hamburg around 1620, after residing for a time in Lisbon and Hamburg. In 1622-1623 he went into partnership, for his Spitsbergen whaling operations, with two Basque merchants, one from Ciboure and one from Saint-Jean-de-Luz, who provided one ship, while Braem chartered a second ship in Amsterdam. At this very time he was also a royal official in

charge of King Christian IV's own private whaling enterprise.

Exactly the same kind of problem arises in the early days at Spitsbergen. There were just as many disputes between Muscovy Company ships and other English so-called interlopers, and between the Noordsche Compagnie and other Dutchmen, as between the English and Dutch, and these last disputes were between the two companies, not nations. I suggest, therefore, that we start writing non-national whaling history. That is, let us take whaling history fishery by fishery, or area by area, or even town by town, rather than nation by nation.

It is a curious fact that the origins of European Arctic whaling are shrouded in mystery. What we know of its early history seems to move in unaccountable steps with inexplicable gaps between them. In the sixteenth century European whaling was still North Atlantic rather than Arctic in character. From about 1530 Basque whalers were catching nordkapers or great right whales *Balaena glacialis* along the shores of the Strait of Belle Isle between Labrador and the island of Newfoundland and, from around 1570, ships were going annually from Hull in Yorkshire to Vardø in Finnmark (which the English then called Wardhouse) and bringing back fish and whale oil. The whales, which were nordkapers, were apparently killed by Norwegians (Gillet and MacMahon 1980: 143-145). The try-works and nordkaper bones that were found at Vardø in 1882-1883 and were thought to have been the remains of Dutch activities (Sørensen 1912:1916), may well have belonged to this English trade. In 1577 the Muscovy Company (Willan 1956) acquired a royal monopoly to kill whales wherever they chose and to hire Basques to help them, but no Arctic whaling was embarked on. In 1594, the year when the Bristol ship *Grace* brought back a load of whalebone taken from a wrecked Basque whaler in St. George's Bay, Newfoundland, the Dutch actually caught their first whale. Its capture close inshore off the mainland Russian coast south-east of Ostrov Kolguyev was described by Jan Huyghen van Linschoten, who mentions that it yielded twenty tuns of blubber (Van der Moer 1979:197). That was an incident on the first of Willem Barentsz's three expeditions; during the third, in June 1596, Spitsbergen was discovered. Still, there was no Arctic whaling. Even when Henry Hudson, returning from his 1607 voyage to Spitsbergen, reported whales in plenty in Whales Bay (now Kongsfjord) (Pows 1928: 31-38), no effort was made to hunt them. The object of the Muscovy Company, in sending Jonas Poole north in 1610, was evidently to discover the elusive North-East Passage rather than search for whales. No whaling gear was taken. It was only finally in 1611, on the strength of Poole's detailed report, that the company fitted out two ships, hired six harpooners from Saint-Jean-de-Luz, and sent Jonas Poole and Thomas Edge to Spitsbergen specifically to catch whales.

There seems to be no direct connection between the different earlier sub-Arctic whale fisheries, nor between them and the Arctic Spitsbergen fishery inaugurated in 1611. Pilot whaling, in which the animals are driven ashore to be killed, is or was found in places colonised by the Vikings and may thus historically be connected with the Norwegian coastal whale fishery, for which there is evidence as early as the ninth century. Both were pursued quite independently of one another and probably of the North Sea (?) whale fishery described by Albertus Magnus in the thirteenth century (Vaughan 1981:16). They were independent, too, of the Basque whale fishery which progressed from the Biscay shores via Iceland, apparently around 1400, to Newfoundland after 1530, always hunting the nordkaper.

When the English Muscovy Company hired some Basques for their 1611 Spitsbergen voyage these people had to switch from one prey species to another and operate much further north than hitherto. In the following year, we are told because the whales were becoming scarcer in Terranova, a San Sebastian ship set course for Spitsbergen instead, piloted there by the Englishman Nicholas Woodcocke, and found numerous whales. In 1613, ten whalers went north from San Sebastian and other Spanish ports and three from the French Biscay ports of Saint-Jean-de-Luz, La Rochelle and Bordeaux. The French ships found whales "likes carps in a fishpond" but had to pay the English a tribute of eight whales. The Spanish ships, which reported that, eighty leagues from the shore "you couldn't see the sea for whales", were attacked, damaged and driven off from Spitsbergen by four armed English ships (Ciriquiain-Geiztarro 1961, Conway 1904, 1906, Lubbock 1937).

The bowhead fishery of the Spitsbergen bays and coasts flourished exceedingly from its initiation by the Muscovy Company until almost the end of the seventeenth century. In 1648, after over thirty years of intensive whaling, we have a graphic description of this bay fishery written by Christian Müller who was on board *Der Schwartze Adler* (Oesau 1955:19-23). Typically, she sailed out of Hamburg with a skipper from Bremen under the Danish flag and her owners were Johan Been, a Dutchman, and his associates. Arriving at Hamburgbukta, they found that their sister ship had already arrived in the bay, tried out over 300 cardels of train oil and loaded half of it. Lying in the bay were five large whale carcases which still had not been flensed through lack of manpower. There was a "great and ghastly stench" and, after a few fine days, the sun had melted the blubber from the decomposing whales, so that oil lay a finger thick all over the surface of the bay. The men were pestered by bears. If someone walked a little away from the try-works, five or six of these animals would advance towards him. The following year, the Hamburgers filled their casks with the chopped up blubber and tried out the oil at home. As late as 1671 Friedrich Martens described succesful whaling in the bays of north-west Spitsbergen.

Long before this, the practice of catching and flensing whales at sea and taking the blubber home for processing had been initiated, possibly by Basque or Dutch whalers. Only the Basques seem to have tried out the blubber on board ship. It has been said that the disappearance of the Noordsche Compagnie in 1642 was followed by an increase in the number of Dutch whalers operating in Spitsbergen seas, but quantitative data to establish this seem so far to have been lacking. Gradually, after about 1650, the practice of trying-out the oil ashore in Spitsbergen was abandoned and more whales began to be caught in or near the pack-ice. Specially strengthened waling ships were built; the Danes and the English (Jackson 1981), failing, it is said, to adapt their methods to the ice fishery, though this again has yet to be proved, dropped out, leaving the Spitsbergen whaling for a time to the Dutch.

Between the middle seventeenth and the middle nineteenth century, that is, more or less between the times of those two great whaling historians and writers, the Hamburger Friedrich Martens (1675, White 1855) and the Englishman William Scoresby Junior (1820), the general nature of the Spitsbergen bowhead whale fishery did not fundamentally change. The whales were caught increasingly in the ice which drifts down the east coast of Greenland, but still, invariably, between 70° North latitude and 80° North, and between the longitudes of Greenland and Spitsbergen. Spitsbergen remained the rendezvous and sheltering place of the whalers right up until the end of the fishery. Jan Mayen, once the scene of a rewarding bay fishery, especially in 1616-1619 and the scene, too, of the tragic overwintering of 1633-1634 (Brander 1955), was only a landmark on the way to the fishery.

Pending the exact figures wich detailed research in the relevant, mostly town, archives, will one day provide, we can obtain some idea of the annual catch of the Spitsbergen fishery by looking at the approximate size of the whaling fleet and the average number of whales taken per voyage (no allowance is made here for escaped whales which subsequently perished), using the tables in de Jong (1979) and other information. In the second half of the seventeenth century something over fifty ships per annum were sailing from Hamburg, Bremen and other 'German' ports, and 126 from Dutch ports (annual average for 1661-1700 from de Jong's Table 1). The catch per-ship voyage averaged four or five, so the annual catch cannot have been much less than 176 x 4.5 = 792 whales. The contribution of French, English, Danish and other ships may have brought this figure to near 1.000, but probably only in some years. For the second half of the seventeenth century, then, the general picture is an annual kill of something less than a thousand whales made by rather under two hundred ships. In some years practically no whales were killed by the Dutch because of wars, for example in 1665-1667 and 1672-1674. In other years, namely in the fifteen years 1675-1689 of peak pressure, whales

were being caught at the rate of very nearly 2.000 per annum. The high peak of Dutch whaling was in 1684, when a fleet of 246 ships set sail for the Arctic; from Hamburg, the largest fleet ever, numbering 83 sail, set out in 1675.

What was it actually like to take a trip to Spitsbergen on a Dutch whaler in the golden age of the fishery? One of the most graphic surviving accounts is by Johann Dietz of Halle, who later became an army surgeon and a court barber (Miall 1923: 117-160). It must have been when he was in his early twenties, in 1685-1690, that he met three Dutchmen from Rotterdam when he was staying in Hamburg. They had come with their ship *De Hope* in order to recruit crewmen and buy provisions for Willem Bastaensz's three whaling ships. Dietz signed on, bought himself a medicine launched, each manned by six men. The whale is towed to the ship and six or eight men leap onto it to flense it. The chopped up blubber is sent down to the hold in a canvas chute to be stowed in the casks below. The flesh and bones are left in the sea and attract Polar bears and large white gulls. Many bears are shot; the skins are carefully cleaned and packed in sacks with sawdust. They capture one bear alive, a hundred miles from the shore, and haul it aboard, but it escapes and the alarmed crew take to the rigging until the skipper floors it with his flintlock. The resultant roast bear meat is much appreciated. The crew are up to all kinds of tricks, the captain being an easy-going man. But he will not allow the crew to ease themselves except by going to the gunwale; where they have to hold their breeches with one hand and grip the rigging with the other. However, Dietz is allowed to use the privy in the captain's cabin. This had the disadvantage that, in rough weather, salt water would shoot up through the hole and soak him. There are prayers every evening. Dietz wards off scurvy, which everyone else suffers from, by drinking a total of four gallons of French wine with grated horseradish in it. In the end they are all cured by eating green leaves gathered on Spitsbergen. Things could not have been too bad for our surgeon; he went again in the following year!

During the course of the eighteenth century the size of the combined Dutch-German whaling fleet declined from over 200 in 1700-1740 to around 160 ships per annum in the 1770s; the catch per ship-voyage also declined, to something between two and three whales; and an unknown but perhaps increasing proportion of ships sailed south and west of Greenland: the so-called 'Davis Strait' fishery was born. According to de Jong's Table 23, the annual Dutch-German whale catch in the first eighty years of the eighteenth century was 645 whales, a proportion of which were killed in Davis Strait. The significant drop in the Spitsbergen catch was followed by the dramatic decline of Dutch whaling in the last twenty years of the century, and then its complete collapse during the Revolutionary and Napoleonic Wars, 1795-1804.

De Jong analyses the causes of the collapse of Dutch whaling after 1780 and

shows that the 1777 disaster was not a principal one. In that year (de Jong 1978:412-420) 12 ships, 4 of them Dutch and 7 from Hamburg (Oesau 1955: 171-173) were beset in the so-called West Ice along the north-east coast of Greenland, drifted south for weeks, and were crushed one after another. One of the last surviving ships went down on 11 October. It had had 286 eaters on board, some 250 of them being survivors from sunk ships. A hundred and fifty men eventually made their way to the Danish west coast colonies; double that number died. A narrative of the harrowing adventures of one group of survivors from the *Jacobus* out of Hamburg, written by Jürgen Seeth, was printed soon after the event (Oesau 1937: 231-243). Their ship was first beset on 3 June. By the end of that month there were 27 ships in sight of them, all beset in the ice: 9 from Hamburg, 7 from Dutch ports, 8 English, 2 Swedish and one from Bremen. Their ship went down on 20 August and its crew was divided between four ships. By early October the author and his companions had to divide their time between small boats and ice-floes as they drifted down the Greenland coast. They remained on one floe for 32 nights. On 22 October they saw icebergs as big as Helgoland. From 24 November until 20 March, when some Inuit arrived and rescued them, they camped on a rock off the south-east coast of Greenland which was drenched with water at high tide and during storms, which were frequent.

From the mid-eighteenth century, after a long period of inactivity, some mainly east coast ports in England and Scotland, stimulated by the offer of government subsidies, called bounties, increasingly took up whaling. London, for instance, which sent four ships annually in the 1730s and 1740s, averaged 30 ships per annum in the 1750s, and reached 78 in 1785 (Jackson 1978: 262). In 1816 over 100 English whalers sailed to Spitsbergen but, after 102 in 1820, in which year an English ship reported "36 foreigners" as well (Lubbock 1937: 215), there was a rapid decline to 12 per annum in the 1830s.

After about 1850 it is doubtful if whales were any longer being killed annually in Spitsbergen waters. In 1880 the Peterhead whaler *Hope* enrolled a twenty-one year-old Edinburgh University medical student as surgeon. The *Hope,* captain John Gray, was one of the last Scottish Arctic whalers. The surgeon wrote an entertaining account of his trip, describing the killing of seals and the search for whales further north, for the *Strand magazine.* The captain, who had many Arctic voyages to his credit, claimed to be able to recognize individual whales; he thought that there were only 300 left in Spitsbergen waters. The name of that surgeon was Arthur Conan Doyle, later to become famous as the creator of Sherlock Holmes. Captain Gray may have over-estimated the size of the surviving stock of whales. When the Norwegians began mopping up the population of blue and fin whales *(Balaenoptera physalus)* in Spitsbergen waters from 1890 onwards they did not even see

a bowhead until 1911, and that one was killed (Risting 1922:261). In spite of everything, the bowhead still exists in this area. On 23 April 1979 two were seen in a lead in the ice between north-east Greenland and Spitsbergen in 80°45'North latitude and 5°45'longitude (Muus and others 1982: 459).

In the seventeenth and eighteenth centuries the continental Spitsbergen bowhead fishery was conducted in the main by shipowners in a variety of ports between Rotterdam and Lübeck, in particular Amsterdam and Hamburg, whose ships were skippered and crewed very largely by men from the offshore islands, namely the Waddenzee, East Frisian and North Frisian Islands, from Den Helder (then almost an island) and Texel to Föhr and Sylt. Every year in the early spring a fleet of fishing smacks left the island of Föhr for Amsterdam loaded with whalemen eager to sign on for the annual Greenland voyage. The legendary Matthias Peterson, "Lucky Matthias", who died in 1706 having caught 373 whales, was from Föhr. In summer 1760 it was reckoned that, of the island's 4.500 inhabitants, 1.450 males were away whaling in the Arctic (Dekker 1971: 35, 33).

In the late eighteenth and first half of the nineteenth century it was a group of English and Scottish ports which provided the capital and the skippers for the Spitsbergen whalers. At first, from the mid-eighteenth century, London was supreme; then she was overtaken in the early nineteenth century by Hull which, after the mid-nineteenth century, surrendered her supremacy to the Scottish ports first, Peterhead, then after 1870, Dundee. From the tiny Yorkshire harbour of Whitby, 20 ships sailed annually in 1786-1788, and it was Whitby which was the home port, not only of James Cook but also of William Scoresby Senior, who was credited with catching more whales "than any other individual in Europe", namely 533 (Scoresby 1851: 186). Whether or not this is true, his thirty Arctic voyages did not constitute a record; the commander of an Altona whaler named de Bryhyt went on 54 whaling voyages between 1722 and 1777 (Oesau 1937: 37-46). As for their crews, both English and Scottish whalers left their home ports with more or less of a skeleton crew and picked up the rest, amounting to anything from a quarter to a half of their crew, in the northern isles, Orkney and Shetland.

Besides the areas so far mentioned, the contribution of others to the Spitsbergen fishery was limited. Between 1615 and 1660 one to three or occasionally five ships went to Spitsbergen in most years sailing under Danish royal privilege and fitted out in Copenhagen or, occasionally, Bergen (Dalgård 1962). From 1749 to 1758, the Danish Royal Chartered General Trading Company sent up to four ships annually both to Spitsbergen and Davis Strait (Gad 1973: 282). Because of heavy losses, a prize was offered in 1773 for the best explanation of this failure. It was won by a Danish naval officer called Andreas Henrich Stibolt, who earned a large silver medal from

the Royal Danish Society for Rural Economy for his first answer to the question in 1773, and a gold medal for his second answer the following year, which was backed with figures from Holland. It was used as the basis for a government-supported attempt to set up a Danish whaling industry to be carried out by a fleet of 50 ships under the leadership of an experienced Dutch commander from Den Helder, Jacob Potter. Two hundred ship-voyages to Davis Strait and Spitsbergen were made in 1775-1788 but substantial losses occurred in spite of government subsidies (de Jong 1978: 385-387).

From Bergen and other south Norwegian ports one to four whalers sailed annually through most of the eighteenth century, and from 1755, again with help of bounties, ships sailed from Gothenburg in Sweden, apparently both to Spitsbergen and to Davis Strait. Operating from Bruges from 1665 and again from 1772, and in Ostend from 1727, there were short-lived whale fisheries. The early seventeenth-century whaler Jean Vrolicq may have been Flemish. He apparently lived for a time in Saint-Jean-de-Luz, and had connections with San Sebastian and also Copenhagen. He also served as harpooner with the Noordsche Compagnie before obtaining a charter valid for four years from Richelieu, that is, the French government, to catch whales north of 60° North latitude. He organised French Arctic whaling from Le Havre. In Spitsbergen he annoyed the Dutch by renaming places with French names; he claimed to have discovered Jan Mayen and called it the Isle de Richelieu (Dalgård 1962: 156-160, 183-184). But his efforts bore fruit, and the role of protector and encourager of French whaling was later taken over by Mazarin in 1644. In some years more than ten French ships sailed to Spitsbergen, but the enterprise collapsed in the 1670s (La Roncière 1923: 675-680 and 1934: 433) and French whalers only appeared fitfully in the eighteenth and nineteenth centuries. In 1830, there were three in Spitsbergen waters, and the three-masted ship *Ville de Dieppe* was one of those crushed by the ice in Davis Strait (Lacroix 1938: 34, 36).

The name 'Davis Strait' fishery covers at least three more or less distinct areas or fishing grounds. Firstly, the coastal waters of south-west Baffin Island, especially the two great inlets of Cumberland Sound and Frobisher Bay, and Hudson Strait. This area was penetrated at an early date and fished until the end of Arctic bowhead whaling by Europeans around 1915. Secondly, the coastal waters around Disko and, thirdly, the northern and western coasts and inlets of Baffin Bay, including Lancaster Sound, first penetrated in 1819 and 1820 (Parry 1821: 235-237, 258-259). How many distinct populations of whales were involved it is impossible to say. Indeed it should be emphasised that we do not know that the whale population in Davis Strait and Baffin Bay was distinct from that in Spitsbergen waters. There is some evidence to the contrary: in 1805 a whale was harpooned in Davis Strait

but got away; later in that same year it was killed near Spitsbergen (Eschricht and Reinhardt 1866: 20). And William Scoresby Junior mentions three well-authenticated cases of a stone or bone Inuit harpoon being found in a whale killed near Spitbergen (1820a: 10-11).

The present state of research in whaling history permits us to say little definitive about the Davis Strait fishery. The Dutch and the Germans began it in the 1690s, but, in the 1760s, only about a fifth of the Dutch whaling fleet was going there. Between 1690 and 1730 the Dutch explored and mapped West Greenland and Dutch whalers developed a trade with the Greenlanders as a side-line to whaling which flourished at Disko through the middle of the eighteenth century. Jackson's figures (1978: 270) show that the number of English and Scottish ships sailing to Davis Strait caught up with the number going to Spitsbergen in 1821: in that year 80 ships went to Spitsbergen and 79 to Davis Strait. Numbers were equal again in 1822 (61 and 60 respectively). After that, Davis Strait whalers outnumbered those going to Spitsbergen. Indeed in 1830, 91 British whalers went to Davis Strait and none to Spitsbergen. From 1837, however, against a background of rapid decline of the industry and frequent losses of ships in the ice, the pendulum swung the other way, and for a time more ships went to Spitsbergen. Figures for the second half of the nineteenth century, which were in any case insignificant, have yet to be worked out. The Davis Strait fishery survided longer than the Spitsbergen fishery, namely until the outbreak of the First World War. From 1851 onwards ships or parts of crews overwintered from time to time in Cumberland Sound and an effort was made to diminish financial losses by diversification. The last European port to send out whalers to the Arctic, and the only one after 1900, was Dundee (Lythe 1964).

The Hudson Bay bowhead fishery in the area of Southampton Island remains to be mentioned, though it was primarily American, not European. The Hudson's Bay Company tried to hunt bowheads there in 1719 and 1765-1772 but without success. Then, between 1860 and 1915 American whalers developed a flourishing fishery based on overwintering, and trade and cooperation with the local Inuit. European participation amounted to a total of 29 English and Scottish voyages, as against 117 American. Thanks to the work of Stackpole (1969) and, above all, W. Gillies Ross (1975), we have fuller and more accurate information about this fishery than any of the others so far discussed. We know exactly where the whalemen came from, the times, seasons and years of their activity, the area in which they operated and the number of whales they killed. We know a great deal about the life of the whalemen and their impact on and relationship with the local Inuit inhabitants. The economics of the fishery, so well worked out for Britain as a whole by Gordon Jackson, we know less about. Let us hope that, in the

foreseeable future, historical research will begin to make available comparable information about the other, older, much more significant, and wholly European bowhead fisheries whose history I have tried to sketch out.

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THE HISTORY OF EARLY DUTCH WHALING: A STUDY FROM THE ECOLOGICAL ANGLE

by

Louwrens Hacquebord

"...Just as in our lands the cold is not always equally severe, so is it also in Spitsbergen..." Friedrich Martens 1710.

In 1978 the Arctic Centre started research on the first phase of seventeenth-century Dutch whaling activities in the waters close to Spitsbergen and Jan Mayen Island. This research is mainly concerned with the ecological effects of the whalers' stay in the Arctic. In this multidisciplinary project, attention also was paid to the living and working conditions in the seasonal settlements sited on the west coast of Spitsbergen against the background of the changing climatological and oceanographical circumstances.

Apart from the field study undertaken on the islands in the north west corner of Spitsbergen, a search was made in the Dutch archives for written sources which could provide information concerning events in the North Atlantic Ocean in the seventeenth century. Ship's logbooks, notarial documents concerning fishing disputes and ice damage, freight contracts and receipts were studied from an ecological perspective. The information derived from work in the field has been systematically compared with the information from the archives in order to acquire as comprehensive as possible a picture of the Dutch presence on the Arctic coasts.

Location of the hunting areas

Dutch whaling in the beginning of the seventeenth century took place mainly in the bays and coastal waters of Spitsbergen, which currently on an increasing number of maps is given the modern Norwegian name Svalbard. The most important hunting area lay in the north-west corner of this Arctic archipelago. There is a large bay here which is bounded on the eastern and southern side by steep mountains with glaciers between them. On the seaward side it is separated from the Ocean by two Islands, Amsterdam Island and Danish Island. In the seventeenth century this bay was called *Hollandsche of te Mauritiusbay* and is now named the Smeerenburgfjord.

Apart from this area, in the early years the Dutch also hunted whales in a

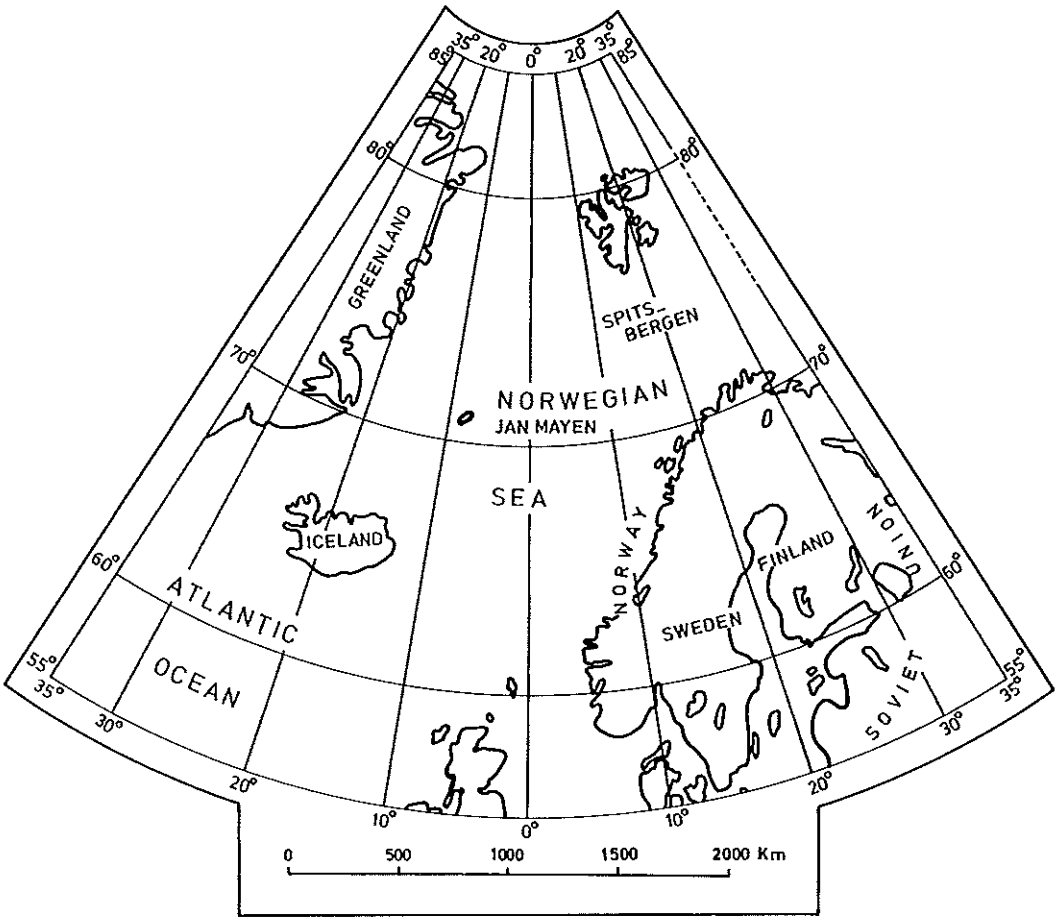

Fig. 1. Location of places mentioned

more southerly area, namely in the waters around Jan Mayen Island at lat. 71° N., and at first this area was more important for the Dutch whalers than Spitsbergen (Fig. 1). The most important species of whale hunted was the Greenland whale or Bowhead (*Balaena Mysticetus* Linné).

The habitat of the bowhead whale

The bowhead whale is an endemic Arctic whale which lives the whole year round near the pack ice. In spring, it used to migrate from the waters south of Greenland along the edge of the pack ice in a northerly direction to the waters around Spitsbergen, and probably even further to the coastal waters of Novaya Zemlya (Zorgdrager 1727 p. 120 ff.). The animal followed the habitat of the plankton until it came to the most northerly corner of its biotope. In the convergence zone, where the relatively warm water of the Gulf Stream and the

cold water of the East Greenland Current meet, (Fig. 2) the waters mix and produce an ideal environment for phytoplankton, which undergoes a short lasting explosive growth when the pack ice disappears and therefore produces an ideal feeding area for the zooplankton which forms the food supply of the bowhead whale. As the seventeenth-century whalers said, "It is a good sign of a large catch of whales when many of the creatures [zooplankton, LH] are seen, for the whales gladly come there and the sea is sometimes so full of them that it swarms"[1]) (Honoré Naber 1930 p. 2). The whale stands at the summit of a very short feeding chain, which is especially efficient since, by virtue of the small number of links involved, little energy is wasted. The zooplankton is composed of a few species but consists of a great number of individuals (Zenkewitch 1963 p. 47). According to Vibe (1967) the most important

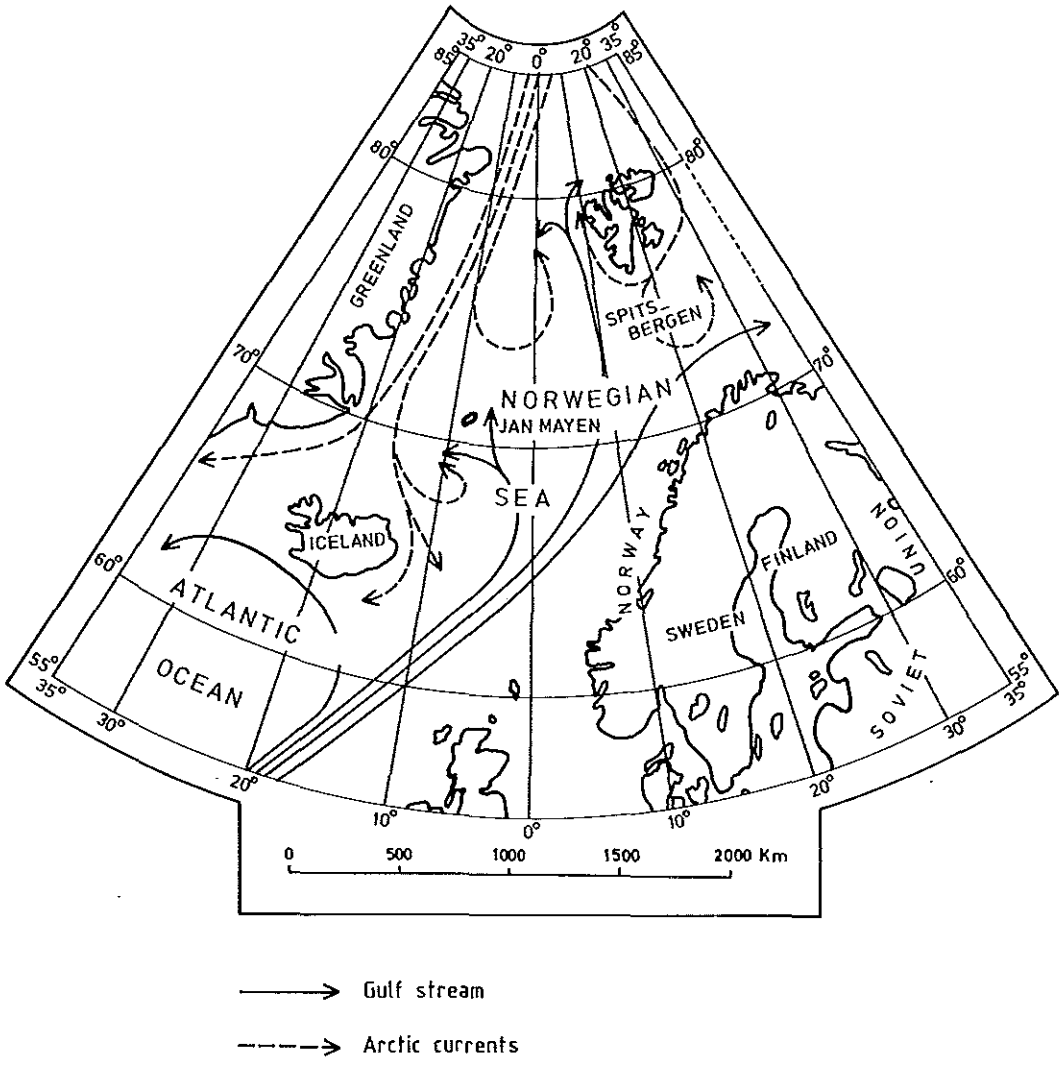

Fig. 2. The general water circulation in the North Atlantic Ocean

feeding places for the bowhead whale lie at the edge of the continental shelf between 200 and 1000 metres deep. When this part of the Atlantic Ocean remained covered with pack ice for the whole summer, the phytoplankton and therefore also the zooplankton failed to develop and the bowhead whale stayed away.

Climatic change and the bowhead whale

From isotope studies of the Greenland and Canadian ice cores it appears that during the 'little ice age' there was a cold phase which lasted from 1570 to 1625. This cold phase was marked by a noticeable advance of the glaciers of northern Scandinavia (Karlèn 1979). During this period the entire Atlantic Oceanic current system expanded and the Gulf Stream moved closer to the Norwegian coast. Within this enlarged Atlantic Ocean current pattern a good mixing took place of the cold Arctic water with the relatively warm water of the Gulf Stream so that, along the edge of the continental shelf, large concentrations of plankton could come into being. As a result of changes in the path of the Gulf Stream and a reduction in velocity of this ocean current, less pack ice melted (Dunbar and Thomson, 1979). Thus it very often happened that during the summer months July and August the edge of the ice-pack lay close to the north east coast of Spitsbergen (Fig. 3). Thus, an ideal habitat for the bowhead whale developed in the bays and coastal waters of Spitsbergen and concentrations of this species occurred there.

The widening of the Atlantic Oceanic current system also brought a larger part of the North Atlantic Ocean into the sphere of influence of the cold Arctic waters. According to Lamb (1979), the Arctic water extended to the waters around the Faroe Islands, to the detriment of the codfishing in this area.

The first cold phase of 1570 - 1625 was, according to the pollen studies, followed by a relatively warm phase which on Spitsbergen had its peak around 1635 (van der Knaap, 1983). The glaciers in northern Scandinavia melted at this time and entered into a phase of recession (Karlèn 1976, 1979). The zonal component dominated the atmospheric circulation in middle latitudes and the sub polar low pressure area moved towards the north, while milder air appeared more frequently in the sub-Arctic and Arctic. In reaction to these changes the Atlantic Oceanic current system shrank, so that a less efficient mixing of the warm and cold water occurred. In the surface water of the Atlantic Ocean the warm water of the Gulf Stream predominated, and the Gulf Stream moved away from the Norwegian coast. This greatly influenced the ice situation around Spitsbergen. The velocity of the whole current system

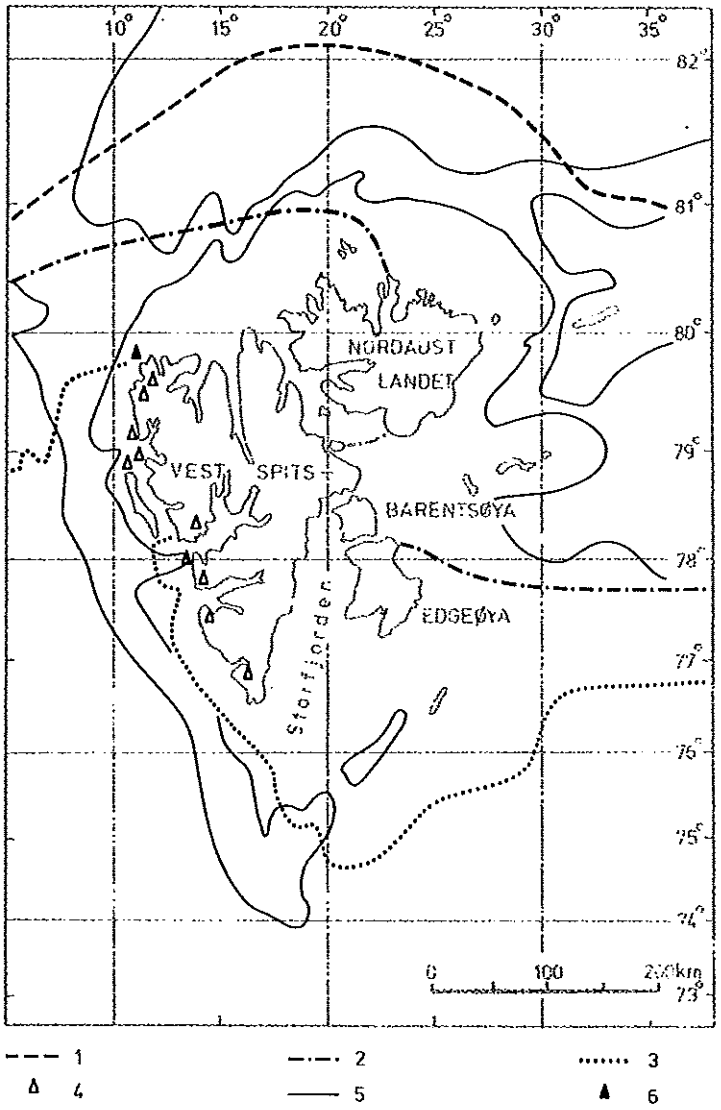

Fig. 3 Average position of the edge of the pack ice in August during the period 1946-1963
1. Minimum extension of the pack ice
2. Average extension of the pack ice
3. Maximum extension of the pack ice
4. English whalingstation
5. The 200-1000 meter depth zône near Spitsbergen
6. Dutch whalingstation

increased and more ice drifted out of the Arctic basin. This ice was transported southwards by the likewise stronger East Greenland Current and the edge of the ice-pack thereby came to lie further from the north coast of Spitsbergen. As a result of these changes the feeding areas of the bowhead whale moved further from Spitsbergen and it was concentrated in its bays less frequently. Reports from Iceland show that at this time the number of weeks with Arctic ice on the north coast increased substantially (Koch 1945). Complaints from Dutch whalers about ice damage and obstruction by ice around Jan Mayen also increased in the sixteen-thirties, while in this period there were no complaints from Spitsbergen waters. In a number of notarial acts it was explicitly stated that there was no excess ice in the bays of Spitsbergen in the years the whaling around Jan Mayen was troubled by ice (various notarial acts and log books of Michiel A. de Ruyter 1633 and 1635, Honoré Naber 1930). Codfishing around the Faroes flourished once again at this time, in keeping with the above events (Lamb 1979).

In the beginning of the 1640s the climatic situation changed again: in middle latitudes the zonal air circulation decreased and the subpolar minimum moved south. Thus the influence of the polar maximum dominated in the Arctic and the average temperature fell. The Atlantic oceanic gyre widened once more and a better mixing of the superficial and deep water occurred. Along the continental shelf around Spitsbergen a favourable habitat for phytoplankton now came into existence. As a result of a diversion in the path of the Gulf Stream towards Norwegian coastal waters, its influence on Spitsbergen decreased. The ice-pack could therefore increase and its summer boundary came once more to lie in the vicinity of the north coast of Spitsbergen. So the bays of Spitsbergen became once more attractive for the bowhead whale, which returned to them more often in large numbers, but only for a short time, because the cooling caused the bays to remain frozen until later in the summer. In the consequent short open season the phytoplankton and zooplankton had insufficient time to proliferate and the whales soon stayed away (Vibe 1967). During this cool period the glaciers in northern Scandinavia advanced, and from historical sources it is known that the glaciers in Spitsbergen also advanced at this time. Friedrich Martens, when he sailed in Spitsbergen waters in 1671, remarked: "Yet, for all this, some greater ice mountains are seen there that stand firm on the shore, and never melt at bottom, but increase every year higher and higher, by reason of the snow that falls on them and then rain freezes, and then snow again alternately; and after this manner the ice-hills increase yearly, and are never melted by the heat of the sun at the top"[2]). In this same period there was little ice in the neighbourhood of Jan Mayen, the bowhead whale was less common there and around 1650 whaling stopped.

The number of notarial acts referring to ice and damage by ice increased

rapidly in the 1660s, and the number of ice years reconstructed from this information rapidly increased. From historical research it appears that between 1660 and 1665 Spitsbergen was bothered with excess ice in four out of five years. The ice situation around Spitsbergen was undoubtedly deteriorating; indeed the ice-pack came so close to the coast that the open water 'lead' very often froze over completely: "it also happeneth sometimes that the land is begirt with ice in summer, as they have often seen that go thither every year"[3]). Concentrations of bowhead whales now only occurred at feeding grounds in the open sea near the edge of the ice-pack (Fig. 4).

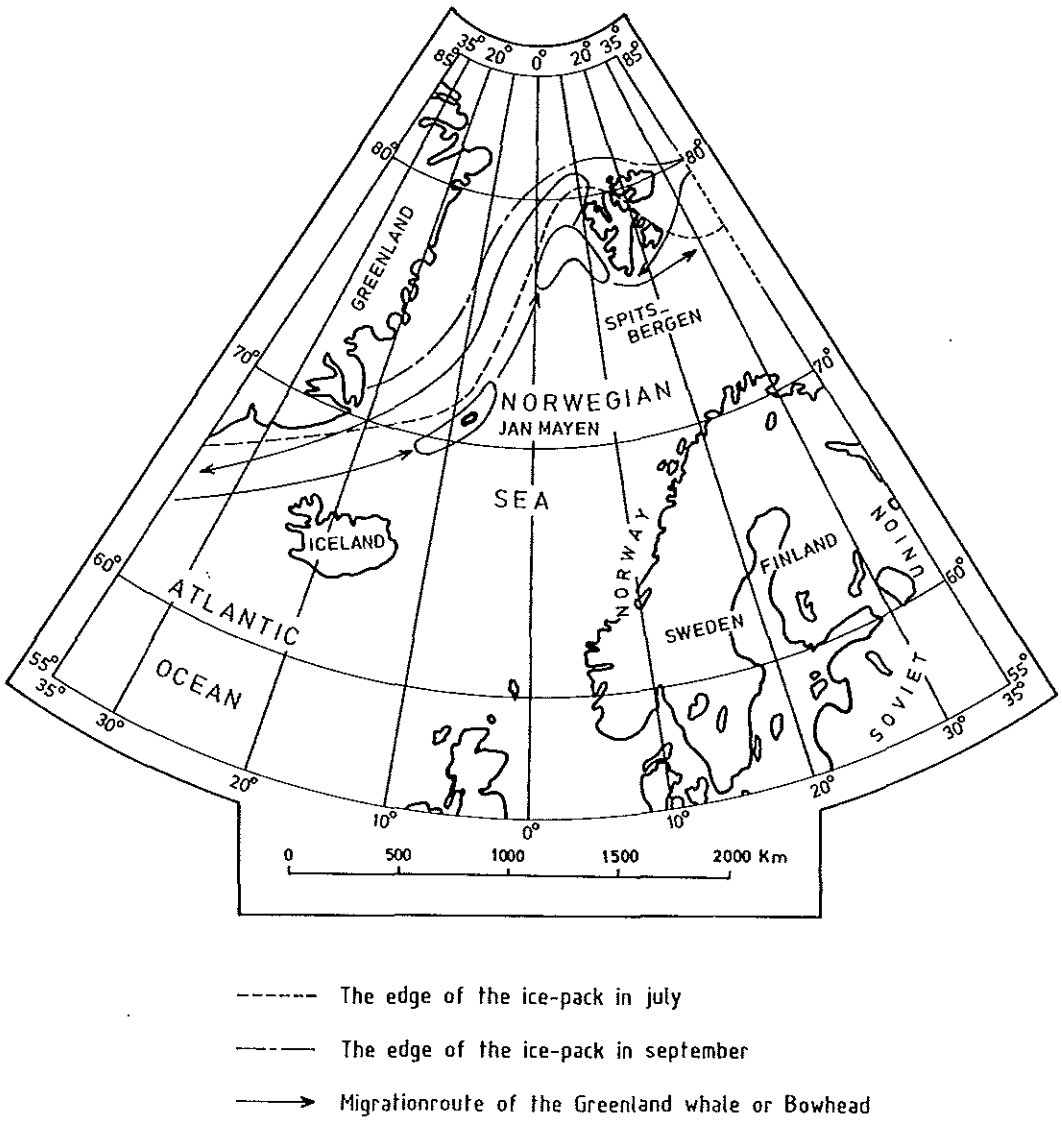

Fig. 4 Relation between the migration route of the Bowhead whale and the edge of the ice-pack in the North Atlantic Ocean

Climatic changes and whaling

When climatic change affects the bowhead whale so dramatically, whaling activities are naturally affected as well. The influence of climate goes much further than the determination of the hunting areas, for the change in hunting areas is accompanied by changes in hunting and processing methods, so that the entire whaling industry has to be reorganised. A combination of historical research and archeological field work permits us to sketch the following developments.

The first Dutch whaling voyages took place in 1612 and 1613, and in these years the whale catch had a very incidental character. The new investment possibilities had been tried without much succes, and their incidental character was shown by the temporary nature of the settlements on the Spitsbergen coast. In 1614, a number of merchants set up the *Noordsche Compagnie* and requested a charter from the States General. Each important port in the Dutch Republic took its place as an independant enterprise or branch (called in Dutch *kamer,* chamber) in this whaling company. In this way, a cartel of whaling enterprises was formed, and agreements were made concerning catches and prices, so that the whaling trade made some impression of order. However, on arrival in the hunting areas, these agreements were often forgotten. Whereever possible, temporary arrangements were made for trying out the whale oil, and at the end of the catching season everything was dismantled, the components which were still usable were taken on board ship, and the rest were left behind. During this first period of Dutch whaling history most of the whaling ships went to Jan Mayen Island. Less important was the whaling on Spitsbergen where, because of English competition, the Dutch whalers were forced to concentrate in the northern bays. In one of these bays some ovens were established on a completely unsheltered beach on Amsterdam Island, which layed approximately one meter above sea level. This location in many ways resembled the situation in the Netherlands, and must have appeared familiar to the whalers. Thus recognition in the light of previous experience may have played an important role in the choice of site for the principal Dutch whaling settlement on Spitsbergen. Among the Dutch, at first only the Amsterdam Chamber of the *Noordsche Compagnie* had a train oil works on Amsterdam Island; the Danish Whaling Company also established themselves there. But after the Danish whalers ceased to visit the place for some years in 1624, the other *Noordsche Compagnie* Chambers established cookeries on this site. The ovens were built for use over a period of several years, and the earlier huts were soon replaced by wooden houses with stoves. In subsequent years a process of adaptation continued, whereby the houses were made more comfortable

under Arctic conditions. The settlement at Smeerenburg consisted of six try-works and approximately fifteen houses with provision for about 150 inhabitants (Hacquebord 1981[A], 1981[B]).

From the excavations, it appears that Smeerenburg had three habitation phases. During the first phase, temporary shelters were made from oars and sail canvas. A culture layer found approximately 50 cm. below ground level containing hardly any building materials formed the remains of this first habitation phase. At the end of the sixteen-twenties Smeerenburg was visited less frequently. Interest in whaling temporarily decreased in the Republic, because a variety of new investment possibilities appeared. The ships fitted out in those years sailed mostly to Jan Mayen Island where whaling was more succesful. In the thirties, because of high oil prices, Smeerenburg once more became busy; more ships arrived and the settlement was improved. The buildings were raised above ground with the help of ballast sand, so decreasing the problem of excess water. This raised layer could be easily recognised on all the profiles and its origin could be determined by identifying the shell remnants in the sand (Den Hartog Jager 1982). A single brick-built house rose between the wooden houses during this second habitation phase at Smeerenburg. The bricks were laid on a clay foundation and the outside of the brick wall was protected from the effects of frost by a wooden wall. The edge of the ice-pack, as mentioned above, moved away from the north coast of Spitsbergen during this phase of the Smeerenburg settlement because of the climatic change around 1625. Fewer bowhead whales came into the bays, and whaling moved into the open sea. In contracts with harpooners the clause "in sea by the edge of the ice-pack"[4]) was used from 1634 (NA no. 963/fol. 77^{v}; Rijksarchief, Haarlem).

Initially, the blubber was mostly cooked in Smeerenburg, but when the distance between Smeerenburg and the hunting grounds increased, the blubber was placed in barrels and, despite the reduction in quality, was cooked in Holland at the end of the catching season. A surviving contemporary notarial act shows that the difference in quality was taken into account in fixing the price. Thus in 1633 there was a price difference of fifteen guilders between a barrel of oil cooked at Smeerenburg or on Jan Mayen Island, compared with a similar quantity cooked in Holland. Blubber was cooked in Holland in spite of this price difference. In the same document it is stated that the Enkhuizen Chamber was already cooking oil in Holland in 1633 (NA 930/133 (1); Rijksarchief, Haarlem). As whaling was now carried out in the open sea, where it was almost impossible to control, the number of ships not belonging to the *Noordsche Compagnie* increased. These so-called interlopers had to barrel the blubber and to cook it in Holland because they were not allowed to cook in Smeerenburg or elsewhere on the coast of

Spitsbergen. At the end of the thirties, however, Smeerenburg was visited less frequently, and a second decline occurred.

When in 1642 the charter of the *Noordsche Compagnie* expired, the members decided not to ask for a prolongation. Since the most important hunting grounds now lay in the open sea, it was thought that the States General would in any case not agree to this. A prolongation of the charter would have involved an extension of the area covered by it, and the States General would, by issuing a monopoly right for the open sea, have been in conflict with the accepted views in Holland concerning the status of the sea. In the forties climate changed once more. After a delay of some years the edge of the ice-pack again bordered the northern coast of Spitsbergen and the bowhead whales once more congregated in the bays there, while they very rarely visited Jan Mayen. Whaling moved back to Spitsbergen, from which the chambers of the *Noordsche Compagnie* attempted to exclude their rivals. A turbulent period followed and, mainly because of the increased number of ships, there was a great deal of activity in the Spitsbergen bays. While many independent Dutch merchants tried their luck with whaling, the leading members of the chambers of the former *Noordsche Compagnie* attempted to revive the expired charter in 1649 en 1651 in order to restore their former monopoly. This failed because the group of interlopers had become too large and powerful. Thus whaling took on the character of a gold rush, mainly concentrated on the Spitsbergen hunting grounds. Everywhere on the coast try-works appeared, and Smeerenburg lost its character as an annual settlement. Evidence from the excavation and the dating of artefacts found during it, shows that after the second habitation phase, Smeerenburg had almost no real inhabitants any more. The ovens were still used during this third phase but the so-called land-men lived mostly on board the anchored ships. Occasionally the skippers even had to be forced by their freight contracts to cook the blubber in Spitsbergen (various notarial acts). Because of the climatic changes, whaling had been transformed from a more or less organised stable industry into a more speculative activity. There was no longer a comprehensive form of organisation. In such a situation, permanent try-works were no longer feasible.

The situation remained as it was for a time, but at the end of the fifties and the beginning of the sixties, both the bay and the sea fishing stopped, and the try-works were dismantled one by one. This transformation was a result of the severe cold period in the second half of the seventeenth century, which caused the bowhead whale to become less frequent in the bays of Spitsbergen. In these decades whaling took place in the drift ice along the edge of the ice-pack.

Whaling activity as a whole adapted to this change. In future, the dead whales were stripped of their blubber alongside the ship, and the blubber was

mostly cooked in Holland[5]). The ships had now a double hull and other technical modifications. The skipper disappeared from the whaling ships and the commander, who before 1640 was only in charge during the whale catch, took his place. The heyday of free enterprise in the whaling trade now began. Up to 1640 an average 16 ships were fitted out each year, and an average annual catch of 90 till 180 whales was achieved. Around 1650, the various whaling companies fitted out about 50 ships, which caught 250 - 500 whales annually. From about 1660 until 1700 the Dutch fitted out 150 - 250 ships, catching 750 - 1250 whales annually. It was this period of free enterprise that was responsible for the extinction of the bowhead whale in the North Atlantic Ocean.

Because of the geographical position of their hunting ground, the Dutch became accustomed from early on to sailing in ice. Even during the period when the Spitsbergen bay fisheries were still active, the Dutch whalers were at times confronted with drift ice. The process of adaptation was therefore very gradual and when natural circumstances rapidly deteriorated the Dutch were not taken by surprise. The English whalers, whose hunting grounds lay in the more southerly bays, had less opportunity to accumulate the experience necessary for ice fishing. This lack of the necessary knowledge, combined with internal problems and strong competition from the Dutch in the whale-oil market, explains why the English did not make the step from bay to ice fishing. As a result, English whaling ceased to exist around 1670 and it was not until the second half of the eighteenth century that English merchants once more sent ships to the north (Jackson 1978).

Conclusion

It is evident that the relationship between whaling and natural circumstances was so close that it is almost impossible to fathom out the history of early Dutch whaling without an understanding of the climatological and oceanographical circumstances during the seventeenth century. Insight into contemporary technical, economic and social developments in Holland is also of importance. Even in whaling not all developments can be explained from the ecological angle. It is noteworthy that, in the first half of the seventeenth century, the waters round Jan Mayen Island were more important for Dutch whaling than the bays of Spitsbergen. Finally, it seems to have been the whaling in the period of free enterprise (especially 1660 - 1700) that was responsible for the extermination of the bowhead whale in the North Atlantic Ocean.

NOTES

1) Het is een goet teken van veel walvischvangst, daer veel van dit ongedierte [zooplankton of "spinnekoppen"] gesien wort, want de walvisschen daer geerne omtrent haer verhouden en de see is somtijts soo vol van dit vuyle tuygh dat het weemelt (Honoré Naber 1930 p. 2).
2) White, 1855:36, English translation of 1694. A later Dutch version has: Echter worden hier de grootste ijsbergen gezien als die tusschen de Bergen staen, welcke noyt van onder en smelten maer alle Jaer grooter werden door de opvallende Sneeuw, Regen, Gladijs ende weer Sneeuw. Op deze wijze nemen d'IJsbergen steeds in aengroey toe zonder oyt door Sonnewarmte van boven te smelten ... (Friedrich Martens 1710).
3) White, 1855:17, English translation of 1694. The 1710 Dutch version has: 't Gebeurt ook wel dat het Lant in de Somer van 't IJs bezet werd, gelijk die geene betuygen die alle Jaren dese Gewesten bevaren (Friedrich Martens 1710).
4) in zee aent ijs
5) During research in the municipal archives at Rotterdam after I gave this lecture I found two notarial acts in which it is stated that the whalers had to cook the blubber on land or on the ship. These are the first references I have come across to cooking on board a Dutch ship (GAR 509/207, 3 April 1658 and GAR 509/249, 30 April 1658; both notary Mustelius from Rotterdam).

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HISTORICAL SURVEY OF FOREIGN WHALING: NORTH AMERICA

by

Richard C. Kugler

A historical survey of Arctic whaling in North America by foreign whalers embraces so large a subject that the boundaries of discussion should be established at the outset. The term "foreign whaling," to begin with, is understood to mean whaling activity by non-indigenous peoples who came to the northern waters of the North American continent. The Eskimos of Alaska, Canada and Greenland and the Indians of the Northwest Coast of North America, each with long histories of whaling for subsistence purposes, are thus excluded from consideration.

The foreign whalers were commercial whalers. They came predominantly from the United States, although the British were present in large numbers in the eastern Arctic. Also in the east were once the Dutch, but their numbers had dwindled and, by the beginning of the nineteenth century, they had largely withdrawn from the waters west of Greenland. In the western Arctic, besides the Americans, were vessels owned and manned by Frenchmen, Germans, Danes, Australians and Hawaiian Islanders. Occasional vessels from Norway, Russia and Chile also appeared from time to time. For all who came, they had one purpose: to take the oil and baleen of the bowhead whale, *Balaena mysticetus.* In terms of chronology, foreign whaling in the North American Arctic took place almost entirely during the years from 1820 to 1910. In two major areas of activity, Hudson Bay and the western Arctic, the span of time was even more compressed, being confined to the last half of the nineteenth century and the first decade of the twentieth. By 1910, market conditions and the stocks of whales had sunk so low that no further incentive for commercial whaling remained.

The geographical boundaries of whaling in the North American Arctic extended from Davis Strait in the east to the Chukchi Sea in the west. To comprehend the history of whaling over this large expanse of space, one further area, outside the boundaries of the American continent, must be included. In the Okhotsk Sea, whaling occurred as an extension of North American whaling and should be viewed as part of the great expansion of the bowhead fishery in the middle decades of the nineteenth century. Within this expanded area, there were four areas of concentrated whaling activity, each having a distinct and largely separate history. Two of the four define the northern extremities of the North American land mass: Davis Strait in the

east and Bering Strait in the west. Each of these straits leads into more northern waters, only briefly free of ice: the Chukchi and Beaufort Seas in the west; Baffin Bay, Lancaster Sound and other inlets in the east. Besides these two areas are two inland seas: Hudson Bay in the east and the Okhotsk Sea on the Asian continent.

In each of these areas, the primary, if not the only, reason for foreign whaling was the presence in large numbers of bowhead whales. Even today, biological knowledge about this whale is rudimentary, probably more so than for any other species of large cetacea. Given the meager amount of information available, it should be noted here that the four areas of major whaling activity do not assume four distinct or discrete stocks of bowheads. The spatial delineations that may or may not separate the world's population of bowhead whales are questions for which the evidence of history does not supply clear answers. Some aspects of past experience may be suggestive, but the data of history is neither specific nor comprehensive enough to determine whether geographical boundaries exist between the bowheads of one area and another.

The temptation to use the behavior of bowheads to substantiate geographical theory is nowhere more evident than in the nineteenth-century arguments supporting the concept of an Open Polar Sea. Advanced with nervous eloquence by Lieutenant Matthew Fontaine Maury of the United States Naval Hydrographic Office in the 1850's, a few years after the first such whales were taken in western North America, the theory relied in part on the bowheads, which have "taught us to suspect the existence of open water in the arctic basin, and in their mute way told of a passage there, at least sometimes." The assumption, of course, was that "the same kind of whale that is found off the shores of Greenland [and] in Baffin's Bay, etc., is found off the North Pacific and about Bering's Strait." To prove the point, Maury canvassed his whaling friends: "Will you find out ... what is the difference, if any, between the whale of Davis Strait and Bering's Strait? Can you provide me with a skull and bones of each? Does the polar whale swim long distances under ice?"[1]) To Maury's enthusiasm, one whaling master countered with a note of caution: "No one man has been in both straits or seen each fish. The opinion obtains by many that the two fish are the same, but so far it is only opinion, not evidence based upon fact."[2]) Notwithstanding the limited evidence, Maury found the theory appealing and called on the bowheads to prove it. When drafting the official instructions for an American expedition sent to the eastern Arctic in search of Sir John Franklin, he advised its commander to "observe closely the habits of the whales, and should these fish take a westerly course, use them as pilots to the open sea beyond."[3]) Maury should not be condemned too quickly, however, for although the theory of

the Open Polar Sea has long since been cast aside by increased geographical knowledge, the question of whether bowheads once traversed the Northwest Passage is still open. Historically, only five hundred miles separate the westernmost kill of bowheads in the east from the easternmost bowheads taken in the west.

Three of the four areas of bowhead whaling, the western Arctic, Hudson Bay and the Okhotsk Sea, were the last of the whaling grounds opened by American whalemen. Together, they represented the culmination of a century of expansion that had uncovered all the world's whaling grounds except those of Antarctica. The story is a familiar one, beginning with the entry into the South Atlantic by American whalemen in the 1760's, followed by the passage into the Pacific by British and Americans in the 1790's. The lure that drew them further into the Pacific was the sperm whale, which represented the greatest value in marketable commodities. Within half a century, the whalemen of the United States, Great Britain, France and Germany could be found throughout the Pacific from 50^0 South to 40^0 North latitude.

During the decade of the 1840's the course and direction of this vast maritime deployment began to alter. One reason for the change was the apparent decline in Pacific sperm whale stocks. Once considered an inexhaustible resource, these whales had been so reduced by intensive hunting that even as early as 1843, the American industry's trade journal, *The Whalemen's Shipping List,* believed that "reflecting and judicious men would no longer join with the host of those who have seemed disposed for some years past to cover [that] ocean with whale ships."[4]) Confirming that judgment, the amount of sperm whale oil brought to the American market reached its highest level in 1843 and began to decline thereafter. Yet for reflecting and judicious whalemen, there was ample reason to continue in the business, if not for sperm whales, then for others. A second development in the 1840's did not escape their notice: between 1841 and 1844, the price of baleen doubled. Full skirts had come to fashion, and baleen was needed to flare them out. Right whales first, then bowheads, were to supply this growing market, and to find them the whalemen headed north. Between 1843 and 1845, the right whale grounds of the North Pacific rim were occupied, stretching from the Kurile Islands and the coast of Kamchatka in the west to the Gulf of Alaska in the east.

Beyond the North Pacific rim, there was an even greater prize. Although the documentation is sparse, Captain Thomas Sodring of the Danish whaleship *Neptun* appears to have been the first of the "foreign" whalers to take a bowhead in the Pacific. The year was 1845; the place was off Kamchatka, and the news spread fast among the whaling fleets. Eleven whaleships, 8 American, 2 French, and Sodring's *Neptun,* called that summer

at Petropavlovsk. There, word circulated of a new kind of whale, heavy in blubber and rich in baleen. Two of those who heard it were the American captains, Mercator Cooper and Thomas W. Roys. Earlier that summer, Cooper had taken a whaleship, the *Manhattan,* into the Okhotsk Sea for the first time. Two French whaleships followed, and although none ventured more than a hundred miles into the Sea, they took 8 right whales and proved the possibilities of whaling in the Okhotsk. Within two years, 30 whaleships, 26 American and 4 French, were whaling there, and between them, they took 341 right whales and 85 bowheads, the first large catch of the species to be made in the Pacific. The other captain, Thomas W. Roys, made a daring but reasonable gamble in 1848. Sailing for Bering Strait in the Bark *Superior*, his crew apprehensive and near mutiny, Roys sailed a thousand miles north of the nearest whaleship, passed Bering Strait and discovered the bowhead grounds of the western Arctic.

In the eastern Arctic, one of the bowhead grounds was new, like those of the Okhotsk and western Arctic. Hudson Bay was first entered for whaling in 1860, being the last of the whaling grounds to be opened by American whalemen and thus bringing to a close a century of worldwide exploration. Only Antarctica remained, awaiting the Norwegians, with their new technology, in the twentieth century. By way of contrast, the last of the bowhead whaling areas of North America was an ancient one. Known generally as "Davis Strait," it came to include Baffin Bay, Lancaster Sound and other inlets and passageways of the Canadian archipelago. Whaling in Davis Strait itself had a long history, stretching back to the 1690's, when Dutch and German vessels began to frequent it. In a recent study, W. Gillies Ross suggests that in about 1820, this older fishery, conducted largely by Dutch and British whalemen along the west coast of Greenland, was replaced by a new effort that focused on the largely unexploited stocks of whales on the western side of the Strait, along the shores of Baffin Island, north to Pond Inlet and into Lancaster Sound.[5])

Over a period of 90 years, 1820-1910, Ross identifies 2,406 voyages to Davis Strait, mostly by British whalers. Half of the voyages took place in the first twenty years of the fishery, 1820-1840. Thereafter, a slow decline began, not as sharp or abrupt as on other bowhead grounds but continuing even after the crash of the baleen market in 1907. In terms of duration, the Davis Strait bowhead fishery outlasted all the others. In terms of effort, the number of voyages identified by Ross come as a surprise; even more so does his suggestion about the scale of productivity. If his initial estimate of 18,000 bowheads killed can be confirmed by a larger sampling of the documentary record, all earlier impressions of the magnitude of the Davis Strait fishery will have to be revised. By inviting consideration of Davis Strait as a fishery of

major proportions, Dr. Ross has performed a signal service to whaling historians everywhere.

If the results of Ross' research stimulate a new look at the Davis Strait fishery, activity in the Okhotsk Sea.[6]) Begun, as we have seen, in 1845, that fishery began in earnest in 1847. Within the Okhotsk were found both right and bowhead whales, with the latter far outnumbering the former. A line of demarcation, running across the Sea from the northern end of Sakhalin Island (54^0 North) to the southern tip of Kamchatka peninsula (52^0 North), separated the two species, with right whales occupying the lower Sea and bowheads the upper. The absence of ice throughout the Sea from the end of July until mid-October deprived the bowheads of their natural protection and made the Okhotsk a hunter's paradise. The intensity with which whaling could be pursued resulted in the extermination of the bowhead population within two decades of the opening of the fishery.

During the 20 years from 1847-1867, 1,391 voyages were made to the Okhotsk Sea, 90 percent being by American whaleships and the remainder by vessels from France, Bremen, Hawaii and Russia, with occasional representation from Britain, Norway and Chile. During these 20 years, Henderson estimates a virtually complete kill of the bowhead population, with 86 percent of that mortality occurring within the first decade. In terms of numbers, Henderson's figures at this stage of his research suggest that 15,200 bowheads were taken and an additional 3,040 killed but not recovered, resulting in a total kill of 18,240. The mortality figures are arrived at by extrapolation from the returns of oil from all Okhotsk voyages, using an average yield of 75 barrels per bowhead. The seemingly low yield figure reflects the relatively large number of small bowheads, known as "pogies," that were taken in the Okhotsk. Comparable figures for right whales, as given by Henderson, are 2,400 taken and 1,200 mortally wounded but not recovered, for a total Okhotsk kill of 3,600. The high ratio of unrecovered right whales, compared to that of bowheads (1 lost for each 2 taken vs. 1:5) was due, Henderson suggests, to differences in hunting tactics: bowheads were usually taken in bays and gulfs, where "stinkers" could be recovered; right whales were taken in open, often rough, water.

Henderson's figures, like Ross' for Davis Strait, are preliminary estimates; they suggest, nonetheless, the need for reconsideration of the effect of the Okhotsk fishery on the overall reduction of worldwide bowhead stocks. Curiously, the precipitous decline of these whales in the Okhotsk did not bring an abrupt end to Okhotsk whaling. Whalemen continued to visit the Sea with some regularity, not as a primary whaling ground but in the course of "loop" voyages that took them to Baja California in the winter, to Hawaii

and the Japan Sea in the spring, and to the Okhotsk in summer for right whales in the lower Sea but occasionally going north to look for the few surviving bowheads. During the 30 years from 1867 to 1896, 92 bowheads are known to have been taken in the Okhotsk; perhaps 10 to 12 more were killed but lost. Today, no bowheads are known to inhabit the Sea.

The largest of the remnant stock of bowheads to survive today is found north of Bering Strait in the Chukchi and the Beaufort Seas. Whether enough are present to perpetuate the species remains an open question; what is certain is that their once large numbers sustained the American whaling industry during the last three decades of the nineteenth century. Between Roys' pioneering passage of Bering Strait in 1848 until 1910, 2,712 voyages were made to the western Arctic bowhead grounds.[7]) As was the case with the 2,400 voyages to Davis Strait, over half occurred within the first two decades of the fishery. Specifically, 57 percent of all western Arctic voyages took place within the first 20 years; in the eastern Arctic 56.6 percent did so. The "oil rush" suggested by these figures recalls the experience elsewhere, before and after, whenever any new whaling ground was opened. The intensity of whaling effort in the early years of the western Arctic fully conforms to the familiar pattern of maximum initial exploitation. By 1855, a mere seven years after Roys' voyage, the drastic decline in bowhead catches led to the virtual, if temporary, abandonment of whaling effort north of Bering Strait. From 220 voyages in 1852, the number dropped to 5 in 1855, 13 in 1856 and 8 in 1857. To the whalemen, the western Arctic appeared to be "fished out."

The experience of the following half century, 1858-1908, would prove appearance wrong, unless the whalemen had indeed "fished out" a discrete stock of bowheads that inhabited the waters from about 53^0 North off Kamchatka to the lower Chukchi Sea, but not beyond Point Barrow. The possible existence of this separate population has been suggested by John R. Bockstoce, relying on evidence accumulated during the most exhaustive analysis ever undertaken of any pre-twentieth century whale fishery. As a hypothesis for explaining the abandonment of whaling effort in the western Arctic in the mid-1850's, it invites further investigation. Seemingly, the only alternative explanation for the subsequent absence of bowheads in the lower Chukchi Sea would have to rely on a theory of adaptive behavior in which the bowheads "learned" to avoid the whalers by moving north beyond Point Barrow to summer in the Beaufort Sea and rarely to descend below 60^0 North, the area in which the remnant stock is found today.

Whatever the explanation for the failure of the fishery in the mid-1850's, the whaling fleet returned in force in 1858, partly because of declining catches in the Okhotsk Sea. New tactics were developed, and the bowheads' autumn feeding grounds near Herald Island were discovered. In these waters, usually

ice free until mid-September, the season of pursuit could be extended, although not without substantial risk. As the ice formed, it did so in two arms that reached out to surround the Herald Island ground. Failure to leave in time could mean disaster, as in 1871, when 32 ships were abandonned to the ice and in 1876 when 12 more were trapped and crushed. During the decade of the 1870's, 58 ships in all were lost; during the entire span of the fishery, the number amounted to 150.

Even at this cost, conditions in the marketplace still lured the whalemen north. By 1880, when petroleum products had severely depressed demand for whale oil, the price of baleen continued upwards. Fashion decreed another 20 years of corsets, bustles and wide skirts, and as long as this was so, baleen alone could make a paying voyage. With this incentive, the whalemen moved into the last resort of the bowhead whales, deep in the Beaufort Sea. To do so, auxiliary steam power was introduced into whaleships, enabling them to operate east of Point Barrow with greater assurance of safety. A base for wintering-over was established at Herschel Island in the 1890's, and here the last chapter in the history of American whaling was played out. In 1907 the end occurred, when a cheaper substitute for baleen was brought to market in the form of spring steel. When the whaling fleet withdrew, the bowheads of the western Arctic were thoroughly depleted.

The methods used to record and analyze the western Arctic fishery by Bockstoce and his associate, Daniel B. Botkin, deserve a brief description, although their application to other fisheries may depend on the existence of comparable amounts of surviving documentary evidence. To assess the impact on the bowheads of non-indigenous whaling in the western Arctic, Bockstoce first assembled a list of all whaleships known to have hunted there. By following the careers of these vessels in trade journals, customs and insurance records and the newspapers of New Bedford and San Francisco, he then compiled a complete list of voyages, numbering 2,712. Of these, useful logbooks or journals were located for 550, or about 20 percent of the total, evenly spaced throughout the years of the fishery. A team of six readers then extracted and encoded on computer data sheets more than 66,000 daily observations of whaling activity, other fauna, weather, sea and ice conditions and any unusual occurences that might effect the hunting effort. The resulting data base, containing close to 20 percent of the total voyage experience during the 67 years of the western Arctic fishery, represents not only one of the longest and most detailed mammalian population records in existence but one of the most complete records of any hunting and catch activity.

Information from the data base was then key-punched onto computer cards and converted to nine-track standard computer tape and processed under several different models selected by Botkin to determine the initial size

of the bowhead population and the effects upon it of commercial whaling in the western Arctic. Allowing for a range of figures, depending on the model used, it appears that from an original population of approximately 30,000 bowheads, 16,600 bowheads were taken, with an additional 2,000 killed but not recovered. Of this total, one third was killed during the first six years of the fishery. By the end of the first twenty years, two thirds were killed, reflecting once again the "oil rush" phenonemen in which undepleted stocks attract intensive hunting activity, with a resulting reduction of the population to a small proportion of its original size.

The final area of bowhead whaling in North America occurred in Hudson Bay. Compared to the effort expended in the western Arctic, the Okhotsk Sea and Davis Strait, it was a minor fishery. W. Gillies Ross again provides us with the most thorough study to date in his monograph, *Whaling and Eskimos: Hudson Bay 1860-1915.*[8]) The fishery began in 1860 and was largely an American enterprise. Ross identifies 146 voyages to Hudson Bay during the 55 years of the fishery, 117 being by American vessels and 29 by those of Britain. The whaling season was short, lasting little more than 30 days, and vessels employed in the fishery found it advantageous to winter-over in order to increase the prospects of a profitable voyage. As in the western Arctic, two thirds of the voyages took place during the first 20 years. The reduction of the bowhead population was probably comparable as well, although catch statistics have yet to be compiled. As in the Okhotsk, the bowheads did not survive within this inland sea.

The commercial extinction of the bowheads of North America and the Okhotsk Sea was accomplished with tactics and technology developed for the most part in the eighteenth century. The introduction of auxiliary steam power on sailing whaleships represented a significant advance and enabled vessels so equipped to penetrate deeper and deeper into the Arctic. The practice of wintering-over, both in the west and east, extended the whaling season and offered the advantage of placing the vessels nearer to the arriving whales in the second summer. Certain improvements were made in the weapons of capture, notably the darting gun which simultaneously harpooned and fired an explosive bomb into the whale. These new techniques and gear came, however, after the initial onslaught, and even without them, the bowheads of North America were probably doomed by the foreign whalers who came to hunt them.

NOTES

1. Letters, Maury to Grinnell, Minturn & Co., Sept. 11, 1849; to William R. Jones, Sept. 15, 1849; to Capt. Thomas W. Roys, Oct. 3, 1849, in: National Archives (Record Group 78). See also Matthew Fontaine Maury, *The Physical Geography of the Sea, and Its Meteorology* 8th edition, 1861, edited by John Leighly. (Cambridge, Harvard University Press, 1963) p. 422-423.
2. "Letters to Maury from Captain Thomas W. Roys, Jan. 19, 1851, and Captain Daniel McKenzie, May 22, 1851", in: *Explanations and Sailing Directions to Accompany the Wind and Current Charts,* 5th ed. (Washington, C. Alexander, 1853) p. 310-315.
3. Maury to Lieut. Edwin J. DeHaven, "Instructions: Rough Draft for Navy Department," May 14, 1850, in: National Archives (Record Group 78).
4. *Whalemen's Shipping List and Merchants' Transcript* (New Bedford, Mass.), March 28, 1843.
5. W. Gillies Ross and Anne MacIver, *Distribution of the Kills of Bowhead Whales and Other Sea Mammals by Davis Strait Whalers, 1820-1910* (Arctic Pilot Project, 1982).
6. For information on the Okhotsk Sea fishery, I am indebted to Dr. David A. Henderson, research fellow at the New Bedford Whaling Museum. Dr. Henderson's study of "Whaling in the Okhotsk Sea" is scheduled for publication in 1984.
7. John R. Bockstoce and Daniel B. Botkin, *The Historical Status and Reduction of the Western Arctic Bowhead Whale (Balaena Mysticetus) Population by the Pelagic Whaling Industry, 1848-1914. Final Report to the National Marine Fisheries Service by the Old Dartmouth Historical Society.* New Bedford Whaling Museum, March 31, 1980. I am also indebted to Dr. Bockstoce for the opportunity to read the manuscript of his work in progress, "Whales, Ice and Men," to be published in 1984. For a critical comment on the Bockstoce-Botkin study, see Michael F. Tillman, Jeffrey M. Breiwick and Douglas G. Chapman, "Reanalysis of Historical Whaling Data for the Western Arctic Bowhead Whale Population," in: Michael F. Tillman and Gregory P. Donovan, eds., *Historical Whaling Records* (Cambridge, Eng.: Reports of the International Whaling Commission, Special Issue 5, 1983), p. 143-146.
8. W. Gillies Ross, *Whaling and Eskimos: Hudson Bay 1860-1915.* Ottawa: National Museum of Man, Publications in Ethnology No. 10, 1975.

PRESENT WHALING: POLICY, QUOTAS AND METHODS; WHALE POPULATIONS

by

Joost G. van Beek

Summary

At the start of this century the hunting of the yet unexploited rorqual species became possible: the era of the modern whale hunt started. At first this hunt was concentrated in the Antarctic, afterwards it shifted to the North Pacific. Just after the second World War the International Whaling Commission was established, which up to the present is charged with the proper conservation of whale stocks. During the first 25 years only quotas for Antarctic stocks were fixed. These were too high and expressed in an odd unit (*B*lue *W*hale *U*nit). The exploitation of other stocks was only regulated by fixing closed seasons and minimum size limits. These measures proved to be completely inadequate to prevent serious overexploitation. During the sixties quotas were reduced and in 1972 the BWU abolished. In the early seventies quotas were also fixed for North Pacific and Atlantic stocks. In 1975 the *N*ew *M*anagement *P*rocedure was adopted, which was a great improvement in whale management and resulted in the protection of most fin and sei whale stocks. Furthermore the Commission's decisions were based, more so than previously, on the advice of the *S*cientific *C*ommittee. The recent adoption of two other regulatory measures greatly influences whale management: (a) the prohibition of the use of factory ships, except for the catch of minke whales (1979); (b) a moratorium on commercial whaling from 1985 onwards, which could only be adopted because of the recent great increase in non-whaling member states. Four whaling countries lodged an objection against the adoption of the moratorium.

The NMP aims at stabilizing stock levels at about the maximum sustainable yield level. Each stock is classified in one of three categories depending on the ratio of the current to the initial stock size. The permitted catch depends on the category, but whaling is prohibited on stocks which are smaller than a certain percentage of the initial stock size.

The SC assesses the status of the stocks using data from catch-per-unit-effort, mark-recovery and/or sightings. At present the NMP no longer operates well, owing to problems in adequately assessing the initial stock size and in determining the yield level. The Commission has also been concerned

with aboriginal whaling. A specific management scheme was adopted in 1982. The jurisdiction of the commission over small cetacean management is questioned by several states, among other reasons owing to their 200 miles zone policy.

Introduction

Dutch sailors participated in Arctic whaling during the seventeenth and eighteenth centuries, and the Netherlands were involved a second time in whaling in this century during the period 1946-1964. The second era of Dutch whaling activity, which took place in Antarctic waters, was not very successful. This is illustrated by the following incident: when the Dutch factory ship sailed from Amsterdam in 1946 many people escorted it and even the national anthem was played. Six months later after the ship's return from Antarctic waters public sentiment had changed. The result of the first trip was a disappointment, the number of whales caught had been far below expectation and so were the profits. This situation did not change until the Netherlands stopped whaling in 1964. Nowadays the Netherlands is one of the so-called conservationist countries, which plead for a moratorium on all commercial whaling. This Dutch point of view can be seen as paying off a debt of honour. The above-mentioned facts explain why so many Dutch scientists are interested in the study of whaling history or whale management. Whaling is part of our history.

In this paper the modern whale hunt, which took place in all waters during this century, will be discussed. The first part of this article consists mainly of a historical review of the regulatory measures taken by the International Whaling Commission. The second part deals with the current management procedures and their scientific basis, whilst in the third and fourth part whale hunting by aboriginals and the management of small cetaceans will be briefly discussed.

Historical review

The discovery of the explosive harpoon, the harpoon gun and the steamship at the end of the nineteenth century made it possible to hunt the fast swimming baleen whale species. Until then it had been impossible to hunt these species because of their high swimming speed and the fact that animals of these species sink after being killed. The introduction of the slipway in the stern of a ship at the start of the twentieth century greatly enhanced the range

of whaling operations, because ships equipped with such a slipway, the so-called factory ships, could operate on the high seas far from land. At first modern hunting was concentrated in Antarctic seas, south of 40° southern latitude. The blue and humpback whale stofks[1]) in this area were decimated mainly by Norwegian and English hunters chiefly operating from factory ships. After the second World War the hunt gradually shifted towards smaller whale species such as the fin and sei whale, which were then also overhunted by Norwegian, English, Russian, Japanese and Dutch whalers. When the stocks of these species declined the smallest baleen whale species became the target: the minke whale. So, in Antarctic waters the pelagic hunt shifted from the big to the small whales (Fig. 1).

After the second World War pelagic catching of baleen whales also took

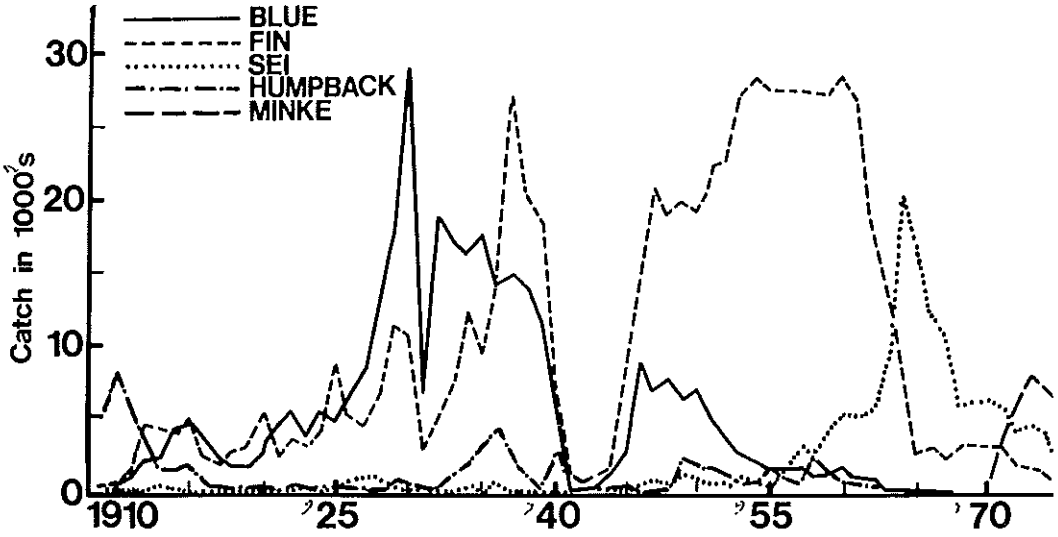

Fig. 1. Catch of baleen whales in the Southern Hemisphere during this century (from Allen, 1980).

place in the North Pacific, but here only Japan and the Soviet Union were involved. More or less the same catch sequence occurred, with the fin and sei whale being the prefered species (Fig. 2). The catch in this area did not reach such high levels presumably because of the smaller sizes of the stocks. Before the second World War a few factory ships operated in the North Atlantic, however in this area most whales were caught from land stations. Both in the nineteenth and the twentieth century the sperm whale was hunted. Figure 3 shows the world catch of sperm whales in relation to the total catch of baleen whales during this century. From the fifties onward the catch of sperm whales increased and the sperm whale became a main target of the whaling industries, especially in the North Pacific.

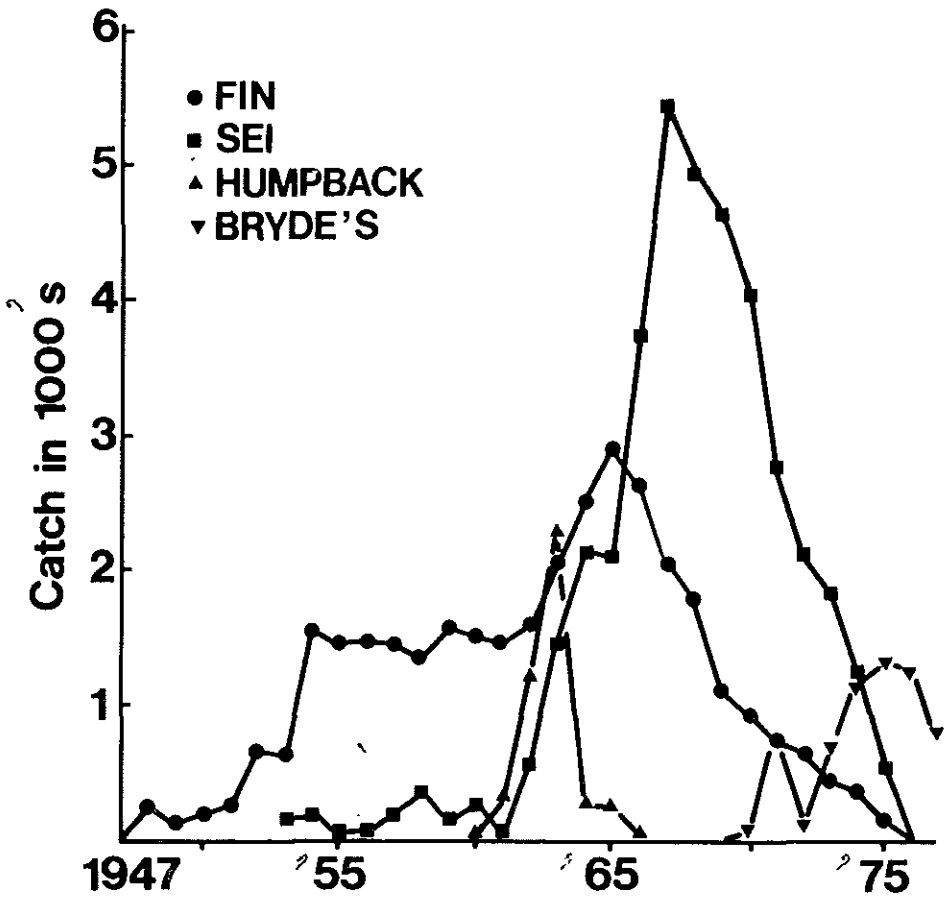

Fig. 2. Pelagic catch of baleen whales in the North Pacific during 1947-1977 (from Allen, 1980).

Most whale species live in the high seas, which in legal terms means that no state has jurisdiction over these species and everyone can exploit them. The management of these resources has to be done internationally. In 1946 the whaling countries established the whaling treaty which at present is still in force: The International Convention for the Regulation of Whaling. Already during the thirties a whaling treaty was in force, but it was of limited scope. In addition to this, several national measures regulated, to some extent, the whale hunt in those days. The 1946 Convention established the *I*nternational *W*haling *C*ommission which was charged with the proper management of whale stocks. The most important regulatory measures taken by the Commission suring the forties and fifties will now be described. Table 1 gives them in abbreviated form.

1. From the beginning the Commission prohibited the commercial catch of gray and right whales; also the killing of calves and lactating females was prohibited.

2. A quota for the pelagic baleen whale catch in the Antarctic was fixed, however the quota was expressed in an odd unit, the *B*lue *W*hale *U*nit. One unit was equal to one blue whale, two fin whales, two and a half humpback whales or six sei whales. This unit was biologically unsuitable and made it possible to shift from one species to another, a practice which clearly does not protect a given species against overexploitation. Besides, the level of the quota was far too high: during the fifties about 15000 units a year were allowed to be caught.
3. Minimum size limits were fixed, for example the catching of fin whales smaller than 50 feet in the Northern Hemisphere was prohibited.
4. Closed seasons and areas were designated. For instance: factory ships were not allowed to operate in the North Atlantic; the pelagic blue whale catch in the Antarctic was restricted in time and the Pacific sector of the Antarctic was made into a baleen whale sanctuary for a number of years (1948-1955).
5. Specific measures in the Antarctic waters for the pelagic humpback whale catch were taken, namely a species quota, a sanctuary during several years in the Atlantic sector of the Antarctic, and a hunting season of only a few days.

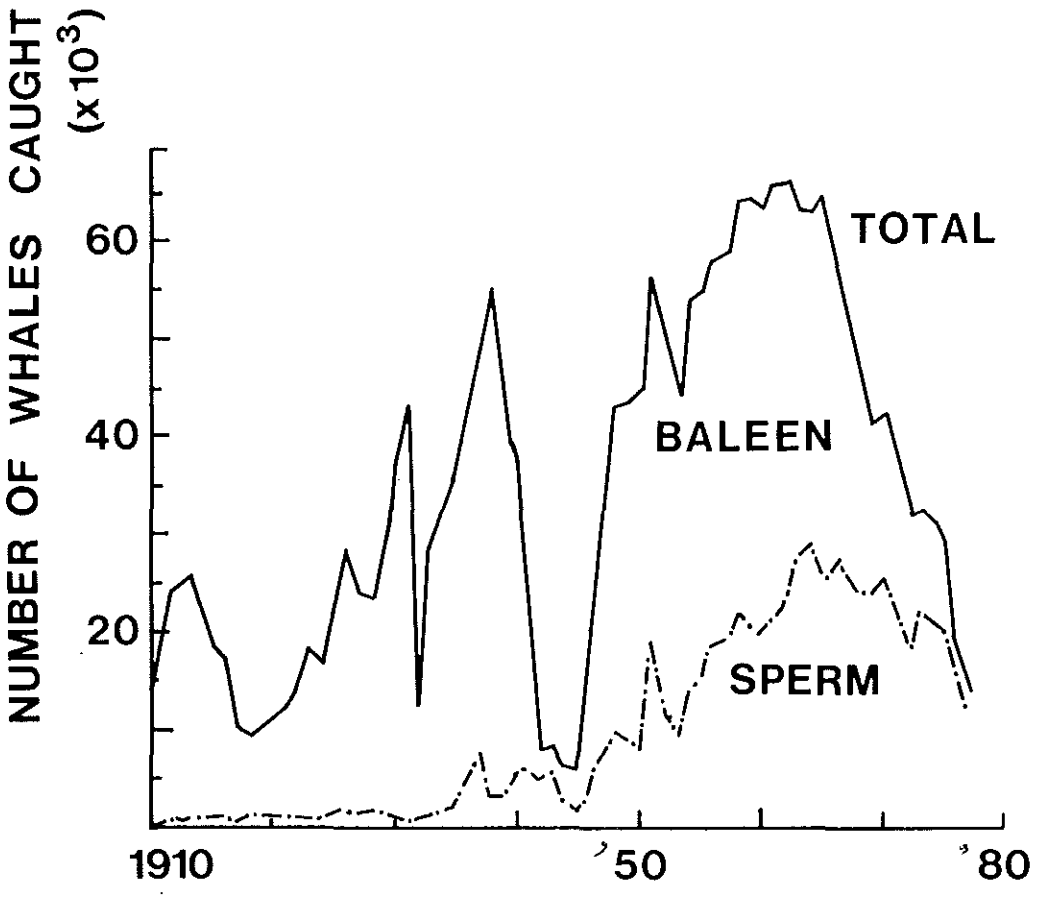

Fig. 3. Total annual catches of baleen and sperm whales in all oceans during this century (from Allen, 1980).

Table 1 Management measures taken by the International Whaling Commission, in abbreviated form.

From 1948	killing of the grey and right whale prohibited
	killing of calves and lactating females prohibited
	Antarctic quota: ±15.000 B.W.U.
	size-limits
	closed seasons
	closed areas
	specific measures for Antarctic humpback whale
From 1962	reduction of B.W.U. to 2300
1965-1967	worldwide protection of the blue whale (In the North Atlantic in 1960)
1963-1965	worldwide protection of the humpback whale (In the North Atlantic in 1953!)
From 1970	species quota for the North Pacific
1972	abolition of B.W.U.
	species quota in the Southern Hemisphere
1975	New Management Procedure adopted
1975-1977	protection for the fin and sei whale, except in the North Atlantic
From 1975	species quota for the North Atlantic
1979	Indian Ocean sanctuary
	pelagic moratorium except minke whales
From 1979	strong reduction of sperm whale quotas to 400
From 1980	action against outlaw whalers, mainly by NGO's
1982	commercial moratorium from 1986 onwards
	aboriginal management scheme

At the start of the sixties not only whale scientists were convinced that the whale stocks were heavily overexploited but also the whaling industry had to admit that the whale stocks were not a resource with an unlimited yield capacity, despite the measures taken. Three independent scientists were invited to advise on the management of the whale stocks in the Antarctic. Their first advice was the substitution of the species quota for the BWU, accompanied by a drastic reduction of the quotas. However, it was not till 1972 that the BWU was abolished, although the BWU quotas were reduced to about 2300 units at the end of the sixties. Their second advice - a complete protection for the blue and humpback whale - was followed up more quickly; during the first part of the sixties the blue and humpback whale were protected worldwide. A second break-through towards better whale management was achieved in 1972. In that year the special United Nations meeting on the environment adopted a whale moratorium resolution, which was passed on to the annual meeting of the Commission. The Commission, however, did not adopt the moratorium proposal but took other actions. It abolished the BWU and established species quota in the Antarctic seas.

(Actually in 1970 the species quota had already been introduced in the North Pacific). Moreover, within a few years a management scheme which aimed at stabilisation of the stock levels at the maximum sustainable yield level would be accepted - The *N*ew *M*anagement *P*rocedure. In 1975 this NMP was adopted and as a consequence (a) most fin and sei whale stocks were protected; (b) quotas were fixed by stock and based more than previously on scientific advice; (c) for the first time quotas were established for the whale hunt in North Atlantic waters.

In 1979 the Commission adopted a prohibition on the use of factory ships except for the minke whale catch, which had the effect of a complete protection for the pelagic sperm and Bryde's whale stocks. Also in this year a whale sanctuary was established in the Indian Ocean above 55° southern latitude. From 1979 on the quotas of sperm whale stocks exploited from land stations were reduced, down to about 400 in 1983. From 1980 on actions from non-governmental organisations like Greenpeace focussed attention on whaling outside the jurisdiction of the Commission (the so-called outlaw whaling) for example whaling from Taiwan and by catchers flying flags of convenience. The Commission prohibited trade in whale products derived from these operations, and this contributed to their cessation. In 1982 a moratorium on all commercial whaling from 1986 onwards was adopted, but four whaling countries - Japan, the Soviet Union, Norway, Peru - objected to it within the prescribed 90 day period and so this decision is not binding on them. At the same meeting the Commission adopted an aboriginal management scheme. In the Intermezzo the 1980 and 1983 quotas are shown and current whaling operations are briefly discussed.

Intermezzo

	1980		1983	
minke whale	11	11758	11	10623
fin whale	2	504	2	287
Bryde's whale	2	724	2	701
sei whale	1	100	1	100
sperm whale	4	2203	1	400
	20	15289	17	12111

This table shows the 1980 and 1983 world quota for commercial whaling by species, the second and fourth column respectively. The numbers in the first and third column indicate the number of exploited stocks. Nowadays only one whale stock is commercially exploited in Arctic waters namely the

Eastern North Atlantic minke whale stock. The quota is 1690 whales and it is taken by Norwegian fishermen operating from small boats, which are also used for fishing. The 6 southern minke whale stocks are pelagically exploited by one Japanese and one soviet factory ship, while Brazil hunts minke whales out of one of these stocks from a land station. The southern minke whale quotas totalled 7072 whales in the 1982/1983 season, of which Brazil presumably will take about 600 whales and the two other countries an equal share of the remaining part. South Korean and Japanese fishermen operating with small catcher boats exploit two North Pacific minke whale stocks i.e. in the Okhotsk Sea, Sea of Japan, Yellow Sea and the eastern coastal waters of Japan. In the North Atlantic two other minke whale stocks are hunted: the Central and West Greenland stocks, by Icelandic fishermen and Greenlanders (aboriginal whaling). Both stocks are also exploited by Norwegian fishermen.

Japanese whalers exploit from a number of land stations on the east coast of Japan one Bryde's whale stock and the only sperm whale stock of which exploitation is still allowed. The other Bryde's whale stock is exploited from a Peruvian land station. Iceland exploits the sei whale and one fin whale stock from a land station located on the west coast. Spain exploits the other fin whale stock from its Atlantic coast (2 land stations). The distribution of the 1983 world quota over the whaling countries is: Japan 38%; USSR 27%; Norway 16%; South-Korea 8%; Brazil 5%; Iceland 4%; Spain 1% and Peru 1%.

The adoption of a moratorium without the support of all whaling countries must be considered against the background of the current composition of the Commission. This composition has changed greatly during the last four years, as can be seen in figure 4. The adoption by the Commission of regulatory measures related to the management of whale stocks needs a three-quarters majority in the Commission. During the initial period of the Commission most member states were whaling countries. Subsequently a number of whaling countries ceased their operations: Britain in 1963, the Netherlands and New Zealand in 1964, the USA in 1971, Canada in 1972, South Africa in 1975 and Australia in 1978. During most of the time the membership of the Commission has been fairly constant. However, during the last five years many non-whaling countries have joined the Commission in order to assist in achieving a more conservationist whale management, namely West Germany, the People's Republic of China, and some small Caribbean states. Also a number of whaling countries joined, namely Chile, Peru, Spain and South Korea. At the last annual meeting (34th) the Commission had 39 members of which 8 were new. The current whaling countries are listed in the Intermezzo. Although in the past the whaling

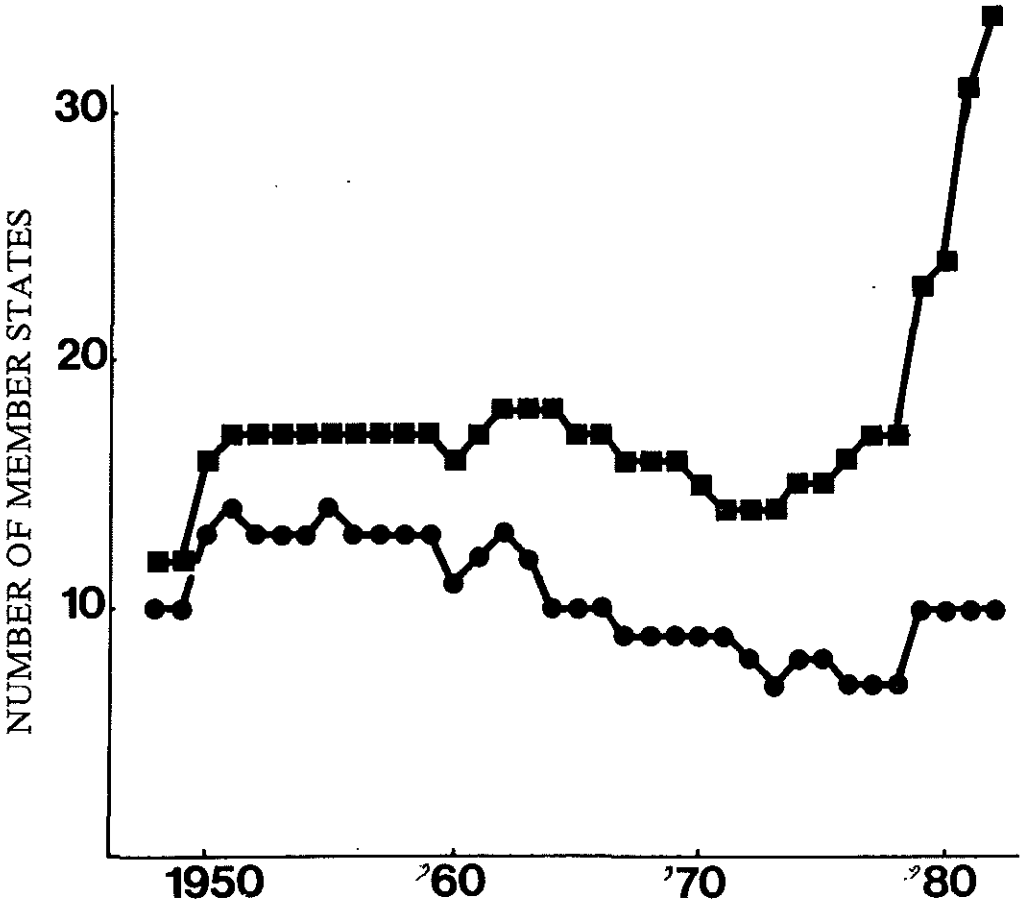

Fig. 4. Trend in the number of member states of the IWC (■) and in the number of member states which are whaling (●).

countries have held up necessary measures for some time, they ultimately agreed upon them, even the NMP. At this moment, however, the non-whaling countries have a three-quarters majority in the Commission and so in theory can impose any measure upon the remaining whaling countries. This happened at the last meeting of the Commission with the moratorium proposal. Some of the arguments behind a moratorium will be discussed below, here only a general argument will be mentioned. Despite all the regulatory measures, the Commission was unable to prevent serious over-exploitation of the major stocks: the blue and humpback whale stocks have been heavily depleted and some are on the verge of extinction or already extinct and most fin and sei whale stocks are also below 50% of the initial size. These facts, which are shown in Table 2, demonstrate the past incapability of the Commission to manage whale stocks properly and for quite a few countries to form the general argument to support a commercial moratorium. All currently exploited stocks, mainly minke and Bryde's whale, should be

given the benefit of the doubt before stocks of these species are also depleted through improper management. The whaling countries oppose this view by arguing that the whales ought to be managed on a stock-by-stock basis because great differences between stocks exist in the level of knowledge about their status. Moreover, the current management scheme, which in their view is a scientifically based procedure, can prevent serious overexploitation.

Tabel 2 Estimates of the current number of whales in proportion of the initial number in two areas (from Allen, 1980).

	Southern Hemisphere	North Pacific
Blue whale	5	30
Humpback whale	2	11
Fin whale	21	38
Sei whale	19	22

The New Management Procedure

Fig. 5 gives a graphical picture of the NMP. For every stock the Scientific Committee of the Commission, which is made up of whale biologists and biomathematicians, calculates a catch limit according to defined rules. The hypothesis behind the NMP is that a stock which is reduced below its initial size has a net production - the so-called yield - because the recruitment rate is always greater than the mortality rate. Because of this net production a stock will return to its initial size of the exploitation ceases. But, if one takes this yield the stock will remain stable. The yield depends on the ratio of the current to the initial stock size. One accepts that in baleen whales the maximum yield is reached at 60% of the initial level - the *m*aximum *s*ustainable *y*ield level - and that the yield then equals 4% of that level - the maximum sustainable yield.[2])

The NMP distinguishes three stock categories. (1) Protection stocks are stocks below 54% of the initial size. No commercial catch is permitted from these stocks. (2) *S*ustained *M*anagement *S*tocks are stocks having a current stock size between 54 and 72% of the initial level. The catch limits for stocks belonging to this category and with a current level at or above MSY-level equals 90% of MSY. This catch limit decreases towards zero for stocks below MSY-level. (3) Initial Management Stocks are stocks having a current size above 72% of the initial size. The catch limit is 90% of MSY. Two features of

the procedure are worth noting: (a) the 54%-level, below which all commercial whaling is prohibited. This is a highly progressive character, which does not occur in most other fisheries treaties; (b) the application of a 10% safety factor.

A first question to be asked is: does any evidence exist that baleen whales have a net production? Several whale biologists have found that in an exploited stock the pregnancy rate increases and the age at sexual maturity decreases, figures 6 and 7. These stock parameters presumably change because of the higher food supply per whale which has been caused by a lower number of whales in the feeding areas as a consequence of the exploitation. The yield is realized by these changed stock parameters. This whole phenomenon if often described as the density dependent response of a stock. There is a possibility that other stock parameters, such as the juvenile and adult mortality rate, are also subject to change. Unfortunately, it is not possible to observe this in whale stocks, since these parameters cannot be assessed adequately. Recently some scientists have shown that the increase in pregnancy rate might be partly spurious and due to the method of analysis used (Mizroch and York, 1982). Also, a decline in the age at sexual maturity can be simulated if errors are made in ageing the whales (Cooke and De la Mare, 1982). So, although there is some evidence that an exploited baleen whale stock has a yield, the exact level of it remains unclear.

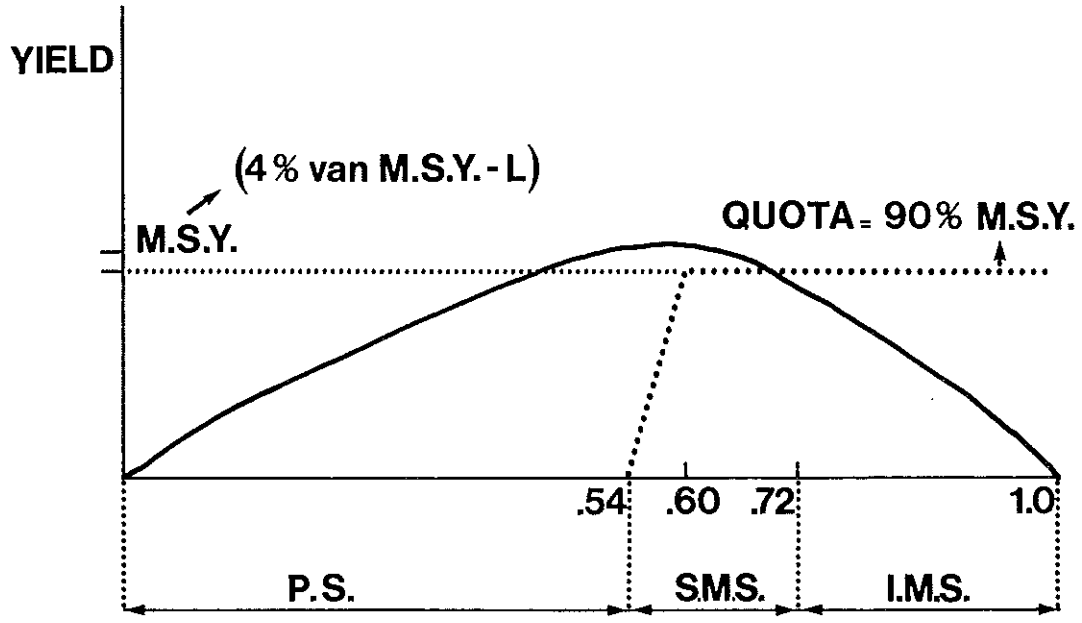

Fig. 5. The assumed yield curve of baleen whale stocks. The absciss gives the ratio of the current to the initial stock size. The ordinate values are 10-fold enlarged compared with the absciss values. The large dotted line gives the quotas. The maximum sustainable yield is indicated as m.s.y. and occurs at 60% of the initial stock size level. The stock categories of the New Management Procedure are Protection Stock -PS-, Sustained Management Stock -SMS- and Initial Management Stock -IMS-.

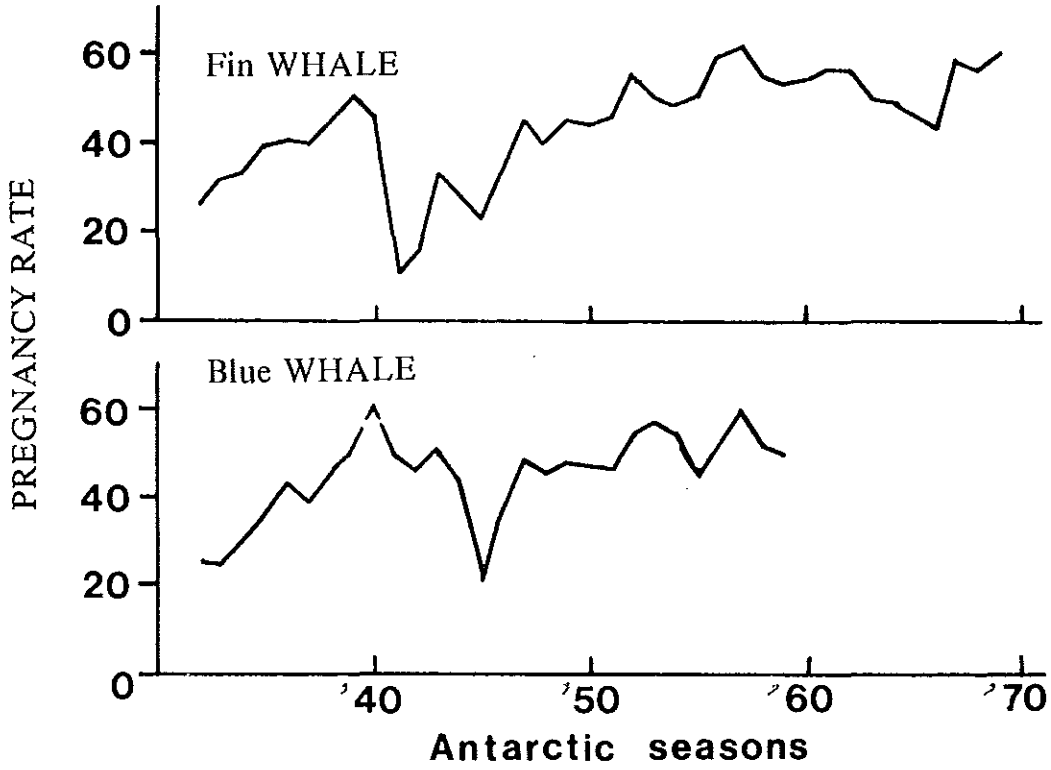

Fig. 6. Number of pregnant females as a percentage of the total number of mature non-lactating females caught each season in the Antarctic (from Gambell, 1973).

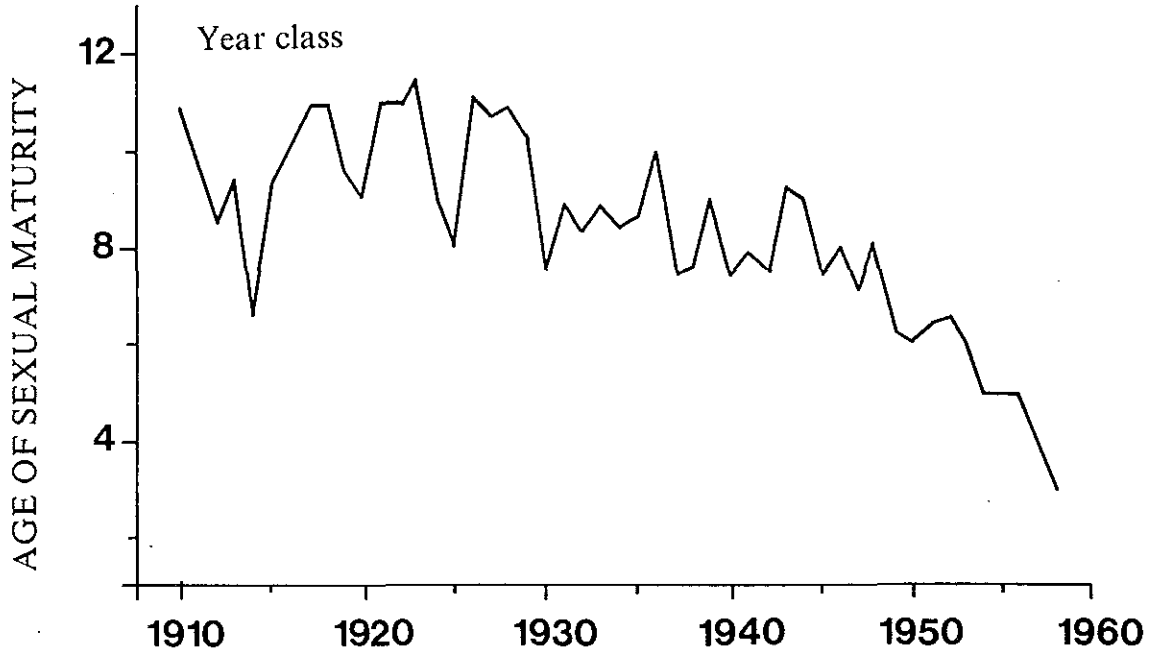

Fig. 7. Age at sexual maturity for different year classes of female fin whales in the Southern Hemisphere determined by the transition in the earplug growth layers (from Lockyer, 1972).

A second question is: how does the SC determine the ratio of the current to the initial stock size? Three types of method are currently used: The first type used the CPUE - *C*atch *P*er *U*nit *E*ffort - variable, which under certain conditions is an index of the stock size. Stocks which have been exploited for a relatively short time can be assessed with the modified Delury technique, in which the CPUE variable is regressed against the accumulated catches. Stocks exploited for a longer period of time can be assessed with an estimation model which minimizes the differences between observed and expected catches. The second type of method determines the current size of a stock by means of the markrecovery technique. Marks are shot into a high number of whales which in subsequent years are killed and the marks recovered. The number of recoveries in the catch is related to the stock size. Besides this some information about the migration pattern of the whales is obtained. In the third method the number of whales seen from vessels in a strip beside the track of the vessel is counted and extrapolated to a larger area. For instance: during the last four years international cruises were organized to the Antarctic pack ice to estimate the stock sizes of the southern minke whale.

Normally with the mark-recovery and the sightings methods only the current stock size can be estimated which implies that the CPUE method is crucial for the proper application of the NMP. However, many disadvantages are inherently related to the use of the CPUE variable. It not only varies according to the stock size but it is also dependent on factors like the weather, time in the season, efficiency of the catcher boats, etc. We can try to correct these other factors with elaborate mathematical procedures, but even after correction this variable fluctuates a great deal. Because of these problems only a few out of seventeen currently (for commercial purposes) exploited stocks can be classified and managed with the above-mentioned criteria of the NMP.

There is, however, a second criterium for classification in the SMS category, namely when a stock has remained at a stable level over a considerable period of time and under a regime of approximately constant catches. Then the catch limit is, in general, the average catch over the last one or two decades. The stable level of such a stock is assessed with a CPUE series. The problem with the CPUE variable as indicator of the stock status, as already mentioned, is that it fluctuates so widely that a significant decline is hard to detect. For instance: computer simulations show that in a stock with an assumed depletion of 50% in 20 years and a coëfficient of variation in the CPUE values of 50% (which is not an unusual variability) there is only a 35% chance of detecting a decline at the 5% level of significance (Beddington et al, 1982). Quite a few stocks are classified with this alternative criterium of a SMS. The other exploited stocks cannot for a variety of reasons be classified

Table 3 The classification of the commercially exploited stocks by species related to the assessment methods used, as proposed by the SC in 1982. SMS-1 and-2 mean classification based on the first and second criterium respectively.

	CPUE	Mark-recovery	Sightings	No/other
Minke whale	3 SMS-2		6 Unclassified	2 Unclassified
Bryde's whale	1 PS	1 IMS	(↔ 1 IMS)	
Sperm whale				1 Unclassified
Fin whale	1 SMS-1			1 Unclassified
Sei whale				1 Unclassified

Total	IMS	1 stock	based on NMP
	SMS-2	3 stocks	
	SMS-1	1 stock	
	PS	1 stock	
	Unclassified	11 stocks	
		17 stocks	

with the NMP. Table 3 gives the assessment methods used for the commercially exploited stocks with the classification as proposed by the SC in 1982. This summary clearly shows the inadequacy of the NMP at this moment, which is mainly caused by two great problems, the unknown level of the density dependent response and the great variation of the CPUE variable.

The SC is unable to solve this inadequacy properly and therefore often suggests to the Commission a number of different catch limits for a particular stock. Most member states of the Commission respond to this by supporting the lowest catch limit, or a moratorium proposal. The Commission at its last annual meeting adopted a moratorium, mainly on the basis of historical - the past history of whale management -, scientific - uncertainties in the scientific assessments - and political - pressure by the public - arguments. Notwithstanding this fact, it can, in view of the four protesting countries, follow an alternative strategy towards a more conservative whale management, namely the adoption of a revised NMP. Such a revised NMP would include the application of safety factors which can reduce the catch limits (calculated on the basis of yield) by 50% and even 100%, depending on the relative stock size, number of assessments used, and the variation in parameter values. The Commission has been talking about such a revision for several years, but without definite results. This adoption would be the third break-through in the management of whale stocks by the Commission.

Aboriginal whaling

The Commission distinguishes two types of whaling operation, namely commercial and aboriginal whaling. A precise definition of current, aboriginal whaling activities is very difficult to give, mainly because of changes in the life of aboriginal people which have taken place during the last decades. A useful distinction between the two whaling operations is that the first type aims at maximizing profits whilst the second type aims at satisfying the subsistence needs of local, aboriginal people. aboriginal whaling only takes place in Arctic waters. Five whale stocks exploited by three different types of aboriginal are recognized namely

1. The Eastern Pacific gray whale stock, which is exploited by Siberian Eskimos with a quota of 179 animals. This stock is still recovering from nineteenth and early twentieth century depletion despite the aboriginal catch of about 150-200 whales per annum since the sixties and currently has an estimated size of about 20000 whales. The commission fixed a quota for the first time in 1977.
2. The Beaufort Sea bowhead whale stock, exploited by Alaskan Eskimos. In 1977 the Commission also fixed a catch limit for this stock for the first time. At this moment a block quota of 65 whales struck and 45 landed during 1981-1983 is in force. (A maximum of 17 landed per year). The status of this last viable stock of bowhead whales causes much concern: the stock level is estimated at 3000-4000 animals (which is far below the commercial protection level) and also the number of calves sighted has been very low. Therefore the SC proposed a zero quota to the Commission.
3. The West Greenland humpback, fin and minke whale stocks exploited by Greenlanders with quotas of 10,6 and about 200 respectively. The Commission already fixed a catch limit for the humpback whale stock in 1960, whilst the other two stocks were recognized as exploited by aboriginals in 1983. However, the quotas date back to 1976. With respect to the humpback whale stock the SC also advised complete protection based on the NMP. Besides the above-mentioned catch limit regulation, the Commission also adopted other regulatory measures, for instance that meat and other whale products may only be used for local consumption, in order to be sure that the aboriginal catch takes place in agreement with the non-commercial character of this type of whaling.

At the last annual meeting the Commission agreed upon an aboriginal management scheme besides the NMP. In this aboriginal scheme catches are prohibited below a certain critical level - the theoretical level which would give a breakdown in recruitment -, and catch limits for stocks above this critical level but below the MSY- level must be fixed in such a way that growth

towards the MSY-level is possible. At the next meeting the SC will try to give its advice to the Commission on aboriginal catch limits within this scheme. Although it can easily be foreseen that this will hardly be possible because of the very limited dataset available for these stocks, the adoption of this scheme nevertheless can be seen as an improvement because it gives guidelines for research workers to obtain the required dataset as soon as possible.

Small cetaceans

Both formerly and nowadays the Commission only manages stocks of large whales, which means stocks of baleen whales, the sperm whale and the northern bottlenose whale[3]). A number of member states, among them the Netherlands, are of the opinion that no legal disabilities exist to regulate also the exploitation of the other toothed whales, usually called small cetaceans or whales[4]). However, quite a few countries, among them the Latin-American ones and Denmark, disagree with this view and claim that the Commission has no jurisdiction with respect to the exploitation of small cetaceans. They argue that the Convention ,and Commission were established with the intention to regulate only the exploitation of the large whales. Moreover, a number of small cetacean species live within the 200 miles zone, and coastal states shall cooperate in appropriate international organizations for their Article 65 of the Law of the Sea clearly states that in the case of cetaceans, states shall cooperate in appropriate international organization for their management. Without a consensus about this controversy within the Commission no management measures can be taken on an international level with respect to small whale species such as the narwal and beluga. Both species live in Arctic waters and are heavily hunted by aboriginals. Even if the Commission agrees that all whale species are covered by the Convention, some member states will oppose the taking of appropriate action. This strong opposition arises from the fact that most of these countries have a big, unregulated catch of small cetaceans; the Faroese (Denmark), for example, take several thousand pilot whales per year and Mexico has a large tuna fleet which incidentally kills many spotted and spinner dolphins.

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NOTES

1) A stock of whales is defined as a group of whales living in a certain area during a fixed period of time. One or more stocks constitute a population.
2) In sperm whales the SC also accepts a yield, especially in males, due to the polygnous behaviour of this species. The underlying model is far more complicated than in baleen whales and therefore is outside the scope of this article.
3) However, the prohibition on the use of factory ships, except for the minke whale catch, not only applies to baleen whales and the sperm whale but also to the killer whale.
4) Although some of these are bigger than the minke whale.

SUMMARY OF THE PANEL DISCUSSION ON THE CONFLICT BETWEEN COMMERCIAL AND ABORIGINAL WHALING

by

Deborah Gottheil

Dr. Michael Tillman (USA) opened the discussion by stating that he was somewhat confused by the title given to the subject under discussion because he was not sure that a conflict presently existed between commercial and aboriginal whaling. The issue that was being raised before the International Whaling Commission ("IWC") by aboriginal whalers in their efforts to preserve their right to continue their aboriginal hunts is the difference between the two types of whaling. In Tillman's view, the only opportunity for conflict to arise between commercial and aboriginal whaling operations is when commercial operations deplete the whale stocks on which aborigines depend to a level which restricts the aboriginal hunts. Sin ce the advent of regulation of commercial whaling by the IWC, this situation seems to have been avoided; however, the Alaskan Eskimos are currently confronted with problems created by Yankee whalers in the previous century.

Tillman then noted that the IWC had acknowledged the differences between commercial and aboriginal whaling by adopting at its 1982 meeting separate management principles for aboriginal whaling. Generally, these principles allow whaling by aborigines to meet their subsistence needs on stocks that are otherwise protected from commercial whaling, if the stocks are above a certain minimum level (below which stocks cannot recover) and the level of take permits the stock to move toward the maximum sustainable yield level.

Dr. Raymond Newell (The Netherlands) asked how, since the IWC was set up to regulate commercial whaling, did aboriginal subsistence whaling become "confused" with commercial whaling.

Dr. Edward Mitchell (Canada) answered that when the International Convention for the Regulation of Whaling was initially being considered, some countries were reluctant to sign it because of its impact on indigenous whaling. This concern resulted in the inclusion in the Convention of the so-called aboriginal exemption clause.

Mitchell also expressed his concern that certain relevant definitions have begun to break down. For example, not all Alaskan aborigines are pure

blood; some Eskimos are descendants of white men. In addition, products of an aboriginal hunt should not be sold, in his view. He stated that the Alaskan Eskimos have had a cash economy since the 1930's.

F.O. Kapel (Denmark) responded to the points raised by Mitchell in terms of the Greenland fisheries. Kapel stated that each situation must be viewed on an individual basis. The issue involves much more than a question of semantics; when looking at the idea of subsistence, one must consider what the products are meant for.

Paul Brody (Canada) asked how the Alaskan Eskimo hunt can be considered "aboriginal" if they relied on such technical innovations as the snowmobile.

Klaus Barthelmess (West Germany) responded that the use of such a technical improvement as a snowmobile should not disqualify the Alaskan Eskimos' hunt of bowheads as an aboriginal whaling operation.

Deborah Gottheil (USA) also stated that the use of the snowmobile did not alter the essential traditional nature of the Alaskan native harvest of bowhead whales. The snowmobile made it easier for the whalers to maintain contact with their families in their villages and to transport essential supplies, but the aboriginal nature of the actual hunt remains intact. Whalers use 16-18 foot skin boats with hand-held oars to approach the whale. As soon as they come up on the whale, the harpooner throws a darting gun that consists of a harpoon with line and float attached and a shell that a plunger triggers and fires into the whale. The gunner, using a shoulder gun adapted from those used by Yankee whalers in the previous century, shoots a bomb into the whale. Once a whale has been struck, other crews come to help tow the whale to the shorefast ice.

Gottheil also took up the points previously discussed by Mitchell. She pointed out that the issue as to whether the International Convention for the Regulation of Whaling applies to subsistence whaling by natives is the subject of litigation in the United States courts (presently "on hold" at the request of both parties). The Alaskan Eskimos are of the opinion that the Convention specifically excludes subsistence whaling by natives. With respect to the matter of whale products being sold by Alaskan natives, she pointed out that the only products of the bowhead whale being sold by Alaskan natives are handicrafts made from whale bone and baleen.

Drs. Ko de Korte (The Netherlands) asked about the impact of the whaling by Alaskan natives on the western Arctic stock of bowhead whales. Tillman (USA) responded that he did not know. He described the two approaches considered by the Scientific Committee of the IWC to determine the trend of the population. The first approach relies on numbers of calves that have been counted. The percentages that have been counted thus far are smaller than

what is considered normal for baleen whales. Reliance on this approach leads to the conclusion that the stock is probably in decline. Most of the scientists, however, acknowledge the problems involved in seeing the calves and believe that the actual percentage of calves is higher. The second approach uses statistical models based on information for other baleen whales as well as the most current life history data on bowheads. Relying on this approach leads to the conclusion that the population may have been growing since 1915 (when commercial whaling on this stock ended) at a rate of about 1 percent per year, even while the Eskimos have been taking an average of 23 whales per year. Because the Scientific Committee always acts conservatively, it has recommended a zero quota.

Allan McCartney (USA) asked if there were anything else that could be causing problems for the bowhead population. Tillman responded that the United States Government is in the process of conducting extensive research on the impact of energy development in the Arctic seas to answer that question.

Mitchell (Canada) offered his views that the statistical models relied on by the Scientific Committee were not sufficient because the scientists do not have the necessary information on growth, age or ovulation rate of the bowhead. He also stated that it is possible that the calf counts are not underestimates because the bowhead is an ice edge animal, calves travel on the side of the mother that would allow them to be seen, and calves do not dive as often as the mother.

Gordon Broadhead (USA) stated that there have been sharp changes in the body of knowledge on the bowhead whale, which have all been positive. The risk element of removing 20 of 25 animals from a population of 4000 is very small, and that allowing such a harvest is essentially buying time until more information becomes available.

In response to a question as to whether or not the gray whale could be substituted for the bowhead whale, Tillman replied that the USSR redesigned their aborigines' culture by taking gray whales for them by catcher boat, and that the United States is unwilling to do the same to its aborigines. He also mentioned that the gray whale is not available to all the Alaskan whaling villages, it is more dangerous to hunt, its muktuk is not as good as the bowhead's and it lacks the cultural significance to the Alaskan natives. Mitchell stated that the bowhead does not have the flexibility in recoverability of the gray whale.

Drs. Van Beek (The Netherlands) stated that with regard to the first criteria of the IWC aboriginal management principles, the scientists believe that the western Arctic stock of bowhead whales is above the minimum level below which aboriginal whaling would be prohibited.

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